Technical Paper 380

DEPARTMENT OF THE INTERIOR
HUBERT WORK, SECRETARY
BUREAU OF MINES
H. FOSTER BAIN, DIRECTOR

PRODUCTION OF EXPLOSIVES IN THE UNITED STATES

DURING THE CALENDAR YEAR 1924

WITH NOTES ON MINE ACCIDENTS
DUE TO EXPLOSIVES

BY
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WASHINGTON
GOVERNMENT PRINTING OFFICE
1925

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First edition. June, 1925

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PRODUCTION AND DISTRIBUTION OF EXPLOSIVES IN THE UNITED STATES DURING THE CALENDAR YEAR 1924 [1]

By William W. Adams

INTRODUCTION

The quantity of explosives manufactured in the United States and sold in 1924 for use by domestic industries has been reported to the Bureau of Mines as follows: 6,683,045 kegs of 25 pounds each of black blasting powder, 55,134,151 pounds of permissible [2] explosives and 273,323,178 pounds of high explosives other than permissibles. These figures are based on reports from manufacturing companies. As compared with the calendar year 1923, the volume of sales in 1924 represented a reduction for black powder and permissibles, and a slight increase for high explosives other than permissibles. For black blasting powder the decrease was 17 per cent, and for permissibles 9 per cent. The increase for other high explosives was 2 per cent.

Coal mining was the largest consumer of black powder and permissibles; metal mining was the largest consumer of other high explosives.

For statistical purposes the consumers of explosives have been classified into four main groups, namely, coal mines, metal and other mines, railway and other construction work, and miscellaneous classes of work. At the request of a number of manufacturers of explosives, the bureau has added a new classification to its report forms for 1925. Hereafter, this series of annual reports will also show the quantity of explosives sold for use by "quarries and nonmetallic mineral mines." Heretofore, the explosives used at nonmetallic mineral mines has been included with metal and other mines, and the consumption at quarries has been included under the heading "miscellaneous."

In 1924 the coal mines of the United States used 84.2 per cent of all of the black powder that was sold, 94.6 per cent of all of the permissibles, and 13.4 per cent of all of the other high explosives.

[1] In this publication "production" of explosives means the total sales during the year as reported by manufacturers.

[2] "Permissible explosives" are high explosives that, because of having passed certain tests prescribed by the Bureau of Mines, are considered reasonably safe for use in gaseous and dusty coal mines.

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Metal and nonmetallic mineral mines used 38 per cent of the high explosives, 2.1 per cent of the black powder, and 0.9 per cent of the permissibles.

Railway and other construction work used 14.9 per cent of the high explosives, 5.1 per cent of the black powder, and 0.5 per cent of the permissibles.

Miscellaneous classes of work, under which quarries have heretofore been included, consumed 33.7 per cent of the high explosives sold during the past year, 8.6 per cent of the black powder, and 4 per cent of the permissible explosives.

CLASSIFICATION OF EXPLOSIVES

The tabulated figures are classified as follows:

1. *Black blasting powder.*—All black powder with sodium or potassium nitrate as a constituent is here classified as black blasting powder.

2. *High explosives.*—Dynamite and all other high explosives of various trade names and compositions, except permissible explosives, are put in the class of high explosives.

3. *Permissible explosives.*—Permissible explosives include ammonium nitrate explosives, hydrated explosives, organic nitrate explosives, and certain nitroglycerin explosives containing an excess of free water or carbon. All permissible explosives have passed certain tests of the Bureau of Mines and are not to be regarded as permissible unless used in the manner specified by the bureau.[3]

ACKNOWLEDGMENT

The compilation of this report is made possible by the hearty cooperation of explosives manufacturers and of Mr. C. Stewart Comeaux, secretary of the Institute of Makers of Explosives. For this cooperation the Bureau of Mines expresses its deep appreciation. The author acknowledges the assistance rendered by Miss L. S. Gerry and Miss E. V. Walters in compiling the statistical tables.

SCOPE OF STATISTICS

The data for 1924 represent sales of explosives by 24 companies. Of these companies 14 sold black blasting powder, 12 sold permissible explosives, and 14 sold high explosives other than permissibles. Some of the manufacturers operated more than one plant, so that the number of companies does not indicate the number of operating plants. Explosives exported from the United States are not included in this report.

[3] Hall, Clarence, Snelling, W. O., and Howell, S. P., Investigation of explosives used in coal mines, with chapter on the natural gas used at Pittsburgh, by G. A. Burrell, and an introduction by C. E. Munroe: Bull. 15, Bureaus of Mines, 1912, 197 pp.; Hall, Clarence, and Howell, S. P., Tests of permissible explosives: Bull. 66, Bureau of Mines, 1913, 313 pp.

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Reports of manufacturers of ammunition and fireworks are not included, because the majority of such companies purchase their explosives from the manufacturers whose production has been included in the tables herein presented. Nor does this publication include the production of nitroglycerin, except in so far as nitroglycerin is used in the manufacture of other explosives.

In addition to the sales of black blasting powder, permissibles, and other high explosives, the present report also includes figures showing the quantities of sodatol and pyrotol used in 1924.

PRODUCTION AND DISTRIBUTION OF EXPLOSIVES

The quantity of each of the three main classes of explosives used in each State during the calendar years 1923 and 1924 is shown in Table 1.

TABLE 1.—*Amount of explosives (excluding exports) manufactured in the United States and used in the various States during the calendar years 1923 and 1924*

State	1923			1924		
	Black blasting powder	High explosives other than permissible	Permissible explosives	Black blasting powder	High explosives other than permissible	Permissible explosives
	Kegs	*Pounds*	*Pounds*	*Kegs*	*Pounds*	*Pounds*
Alabama	173,969	7,761,661	5,290,975	143,947	8,897,075	4,988,600
Alaska	113	2,761,455	95,350	2,773	2,149,980	71,625
Arizona	34,287	11,412,792	30,500	46,210	11,800,175	
Arkansas	66,408	1,522,669	114,300	67,515	1,918,949	99,850
California	195,044	18,642,521	19,700	252,745	17,195,961	17,400
Colorado	79,893	4,173,350	866,150	87,913	4,392,995	711,950
Connecticut	592	704,375	50	769	1,132,825	25,450
Delaware	161	59,607	450	78	109,048	
Florida	4,302	4,022,775	2,750	7,852	5,399,250	4,500
Georgia	14,688	1,211,221	37,344	14,568	1,421,421	10,178
Idaho	19,896	4,335,925	15,450	20,083	4,214,525	19,970
Illinois	1,487,193	6,943,880	3,854,628	1,107,265	6,305,844	3,750,155
Indiana	853,764	3,372,533	921,525	644,683	3,559,784	885,550
Iowa	305,995	2,495,649	50,050	264,829	2,304,475	33,650
Kansas	315,830	7,048,336	104,700	327,116	6,924,784	210,550
Kentucky	687,207	3,779,450	1,900,740	577,802	4,943,596	2,070,375
Louisiana	408	1,304,420	203,250	156	1,866,866	80,300
Maine	1,742	690,922		3,289	636,125	100
Maryland and District of Columbia	31,181	1,701,175	188,455	21,932	1,972,120	93,650
Massachusetts	1,442	843,570	1,000	1,229	976,600	700
Michigan	11,213	18,034,875	46,250	7,072	16,973,590	39,880
Minnesota	59,951	14,657,683		48,565	13,105,496	
Mississippi	2,240	862,113	13,300	3,867	1,735,900	13,500
Missouri	134,647	8,640,809	77,675	97,069	8,404,400	84,270
Montana	116,339	6,414,452	84,450	86,028	6,782,392	35,880
Nebraska	1,766	259,510	100	1,879	224,870	
Nevada	44,946	3,443,540	7,500	40,867	3,625,900	
New Hampshire	702	160,575	1,650	675	216,200	400
New Jersey	1,205	2,437,273	500	724	2,430,366	2,300
New Mexico	12,856	2,549,595	430,850	22,422	2,698,300	374,400
New York	11,741	10,674,422	201,600	14,542	10,704,647	35,100
North Carolina	32,279	3,194,456	27,600	29,060	3,155,808	23,200
North Dakota	45,018	291,425	29,075	33,557	195,750	56,600
Ohio	546,193	8,928,349	135,500	366,195	8,540,527	166,750
Oklahoma	83,405	12,082,919	323,605	85,144	14,076,774	214,681
Oregon	38,967	5,331,853	152,750	38,226	5,953,539	93,870
Pennsylvania	1,565,103	46,450,311	30,278,425	1,332,592	47,349,700	27,641,730
Rhode Island	298	337,700		193	440,050	2,000
South Carolina	2,506	546,025		2,292	546,463	
South Dakota	1,155	1,276,235	500	786	1,248,060	1,150
Tennessee	147,838	2,940,045	638,250	103,930	3,377,340	400,750
Texas	47,843	2,458,795	131,300	32,744	3,071,979	161,700
Utah	23,205	6,500,812	1,029,600	9,220	7,651,520	877,340

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TABLE 1.—*Amount of explosives (excluding exports) manufactured in the United States and used in the various States during the calendar years 1923 and 1924*—Continued

State	1923			1924		
	Black blasting powder	High explosives other than permissible	Permissible explosives	Black blasting powder	High explosives other than permissible	Permissible explosives
	Kegs	*Pounds*	*Pounds*	*Kegs*	*Pounds*	*Pounds*
Vermont	4,620	878,603	250	7,184	342,975	200
Virginia	108,366	3,715,825	983,700	88,897	3,740,232	906,725
Washington	50,462	8,871,855	751,920	49,607	8,904,810	709,965
West Virginia	592,682	5,331,775	10,786,135	522,447	4,928,428	9,267,887
Wisconsin	2,645	4,322,995	2,000	2,743	3,758,575	
Wyoming	113,747	1,022,109	539,462	61,764	1,016,189	938,830
Total	[1] 8,078,053 [2] 201,951,325	267,405,220	60,371,314	[1] 6,683,045 [2] 167,076,125	273,323,178	55,134,151
Grand total (pounds)		529,727,859			495,533,454	
Quantity used for—						
Coal mining	7,019,550	37,828,979	56,806,709	5,625,002	36,608,067	52,147,201
Other mining	174,929	105,003,900	783,475	144,498	103,836,403	514,870
Railway and other construction work	370,442	31,930,021	324,225	341,377	40,647,216	264,920
All other purposes	513,132	92,642,320	2,456,905	572,168	92,231,492	2,207,160
Total	8,078,053	267,405,220	60,371,314	6,683,045	273,323,178	55,134,151

[1] Kegs of 25 pounds. [2] Pounds.

BLACK BLASTING POWDER

The quantity of black blasting powder sold in 1924 for use in the United States was 6,683,045 kegs, or 167,076,125 pounds. This amount represents a decrease of about 17 per cent as compared with 1923 and 7 per cent as compared with 1922. The decrease was due to the greater use of permissibles in coal mining and, with respect to 1923, it was due also to the reduction in the amount of coal mined in 1924.

The coal-mining States were, of course, the largest consumers of black powder. Pennsylvania used 20 per cent of all of the powder sold during the year, and the coal mines were the principal consumers. Illinois used 17 per cent; Indiana, 10 per cent; Kentucky, 9 per cent; West Virginia, 8 per cent; and Ohio, 5 per cent.

Of the total amount of black powder sold in 1924, coal mines used 5,625,002 kegs (84.2 per cent); metal and other mines used 144,498 kegs (2.1 per cent); railway and other construction work used 341,377 kegs (5.1 per cent); and miscellaneous work used 572,168 kegs (8.6 per cent).

HIGH EXPLOSIVES

Reports of manufacturers for the year 1924 showed that 273,323,178 pounds of high explosives other than permissibles were sold for use in the United States. This amount exceeded all previous records; it

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was 2 per cent above the amount sold in 1923, 30 per cent above 1922, 60 per cent above 1921, and 4 per cent above 1917, the year of largest sales prior to 1923. Of the total quantity of this class of explosives sold during the past year, 38 per cent was used by mines producing metals or nonmetallic minerals, 13.4 per cent by coal mines, 14.9 per cent for railway and other construction work, and 33.7 per cent for miscellaneous purposes, including stone quarrying.

The total amount sold was distributed among principal consuming States as follows: Pennsylvania, 17 per cent; California, 6 per cent; Michigan, 6 per cent; Oklahoma, 5 per cent; Minnesota, 5 per cent; Arizona, 4 per cent, and New York, 4 per cent. Each of these States used more than 10,000,000 pounds of high explosives in 1924.

PERMISSIBLE EXPLOSIVES

Sales of permissible explosives in 1924 amounted to 55,134,151 pounds, according to the reports from manufacturing companies. This total was about 9 per cent less than the total for 1923, the decrease being due to the decline in the production of coal during 1924. As compared with previous years, however, the sales in 1924 represented an increase of 21 per cent over 1922, 25 per cent over 1921, and 2 per cent over 1920, the record year prior to 1923.

As for black blasting powder, the coal-producing States were the principal consumers of the permissibles sold in 1924. Pennsylvania used 50 per cent of the total quantity, West Virginia 17 per cent, Alabama 9 per cent, Illinois 7 per cent, and Kentucky 4 per cent. Each of these States used 1,000,000 or more pounds of permissibles, and their aggregate consumption for the year was more than 47,000,000 pounds.

Of the total quantity of permissible explosives sold during the year, coal mines used 94.6 per cent. The remainder was reported as follows: Metal and nonmetallic mineral mines, 0.9 per cent; railway and other construction work 0.5 per cent; and miscellaneous purposes, 4 per cent.

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TABLE 2.—*Amount of black blasting powder used in the United States during 1923 and 1924, classified by use*

[Kegs of 25 pounds each]

Groups of States	Black blasting powder							
	1923				1924			
	Coal mining	Other mining	Railway and other construction work	All other purposes	Coal mining	Other mining	Railway and other construction work	All other purposes
	Kegs	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*
Group 1. Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont	----------	10	262	8,532	----------	46	68	12,456
Group 2. Connecticut, New Jersey, and New York	----------	1,400	622	11,516	----------	697	1,864	13,474
Group 3. Delaware, District of Columbia, Maryland, and Virginia	123,636	1,245	6,756	8,071	85,561	605	19,261	5,480
Pennsylvania	1,455,726	1,529	3,568	104,280	1,260,634	151	5,883	65,924
West Virginia	552,051	1,270	29,302	10,059	497,109	----------	17,409	7,929
Group 4. Florida, Georgia, North Carolina, and South Carolina	5,064	5,958	28,461	14,292	4,070	3,708	28,597	17,397
Group 5. Indiana and Kentucky	1,480,440	4,149	18,755	37,627	1,150,190	2,716	23,100	46,479
Illinois	1,471,983	2,495	586	12,129	1,080,849	2,460	10,420	13,536
Ohio	500,995	9,146	193	35,859	319,241	10,302	390	36,262
Group 6. Alabama, Mississippi, and Tennessee	260,610	9,963	16,769	36,705	199,054	5,447	20,869	26,374
Group 7. Michigan, Minnesota, and Wisconsin	9,391	57,825	2,073	4,520	4,927	45,937	2,057	5,459
Group 8. Iowa, Kansas, Missouri, and Nebraska	699,831	2,483	14,099	41,825	636,696	4,185	7,587	42,425
Group 9. Arkansas, Louisiana, Oklahoma, and Texas	153,609	5,497	11,801	27,157	149,332	4,647	11,092	20,488
Group 10. Montana, North Dakota, South Dakota, and Wyoming	214,250	4,222	32,422	25,365	149,154	1,453	12,536	18,992
Group 11. Colorado, New Mexico, and Utah	71,928	5,565	27,181	11,280	71,951	5,014	28,493	14,097
Group 12. Alaska, Idaho, Oregon, and Washington	19,977	497	69,711	19,253	16,224	1,262	59,007	34,196
Group 13. Arizona, California, and Nevada	59	61,675	107,881	104,662	10	55,868	92,744	191,200
Total kegs	7,019,550	174,929	370,442	513,132	5,625,002	144,498	341,377	572,168
Grand total (kegs)	**8,078,053**				**6,683,045**			

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TABLE 3.—*Amount of high explosives used in the United States during 1923 and 1924, classified by use*

Groups of States	High explosives other than permissible explosives							
	1923				1924			
	Coal mining	Other mining	Railway and other construction work	All other purposes	Coal mining	Other mining	Railway and other construction work	All other purposes
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Group 1. Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont	----------	13, 196	1, 201, 396	1, 696, 778	----------	45, 118	893, 256	1, 673, 576
Group 2. Connecticut, New Jersey, and New York	----------	4, 954, 000	2, 717, 714	6, 144, 356	----------	4, 201, 550	3, 610, 077	6, 456, 211
Group 3. Delaware, District of Columbia, Maryland, and Virginia	714, 100	463, 100	1, 747, 190	2, 552, 217	488, 018	623, 300	2, 374, 302	2, 335, 780
Pennsylvania	27, 717, 901	614, 675	1, 735, 963	16, 381, 772	28, 696, 186	883, 325	1, 630, 162	16, 140, 027
West Virginia	1, 538, 970	----------	1, 647, 480	2, 145, 325	1, 498, 611	----------	1, 802, 679	1, 627, 138
Group 4. Florida, Georgia, North Carolina, and South Carolina	56, 050	1, 608, 962	2, 811, 975	4, 497, 490	54, 225	1, 470, 397	3, 450, 825	5, 547, 495
Group 5. Indiana and Kentucky	1, 577, 589	375, 100	2, 037, 025	3, 162, 269	1, 547, 481	127, 175	3, 098, 765	3, 729, 959
Illinois	319, 475	2, 246, 150	884, 375	3, 493, 880	415, 188	755, 988	1, 077, 838	4, 056, 830
Ohio	1, 128, 008	531, 069	2, 220, 716	5, 048, 556	466, 898	625, 236	1, 935, 009	5, 513, 384
Group 6. Alabama, Mississippi, and Tennessee	1, 379, 956	6, 258, 400	1, 443, 015	2, 482, 448	849, 900	7, 297, 375	2, 443, 075	3, 419, 965
Group 7. Michigan, Minnesota, and Wisconsin	69, 475	28, 064, 008	1, 061, 489	7, 820, 581	52, 150	25, 881, 812	1, 347, 315	6, 556, 384
Group 8. Iowa, Kansas, Missouri, and Nebraska	1, 982, 220	9, 336, 853	1, 552, 560	5, 572, 671	1, 510, 815	10, 017, 875	1, 046, 702	5, 283, 137
Group 9. Arkansas, Louisiana, Oklahoma, and Texas	176, 800	11, 380, 875	1, 646, 094	4, 165, 034	110, 850	12, 475, 875	2, 571, 538	5, 776, 305
Group 10. Montana, North Dakota, South Dakota, and Wyoming	430, 600	6, 201, 505	678, 505	1, 693, 611	293, 650	6, 158, 377	1, 059, 985	1, 730, 379
Group 11. Colorado, New Mexico, and Utah	594, 685	10, 092, 500	556, 755	1, 979, 817	417, 195	10, 841, 300	1, 811, 033	1, 673, 287
Group 12. Alaska, Idaho, Oregon, and Washington	141, 100	5, 809, 560	3, 517, 583	11, 832, 845	206, 200	5, 372, 195	5, 276, 397	10, 368, 062
Group 13. Arizona, California, and Nevada	2, 050	17, 053, 947	4, 470, 186	11, 972, 670	700	17, 059, 505	5, 218, 258	10, 343, 573
Total (pounds)	37, 828, 979	105, 003, 900	31, 930, 021	92, 642, 320	36, 608, 067	103, 836, 403	40, 647, 216	92, 231, 492
Grand total (pounds)	**267, 405, 220**				**273, 323, 178**			

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TABLE 4.—*Amount of permissible explosives used in the United States during 1923 and 1924, classified by use*

Groups of States	Permissible explosives							
	1923				1924			
	Coal mining	Other mining	Railway and other construction work	All other purposes	Coal mining	Other mining	Railway and other construction work	All other purposes
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Group 1. Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont		100	1,600	1,200		400	2,200	800
Group 2. Connecticut, New Jersey, and New York		201,450	100	600		31,450	28,050	3,350
Group 3. Delaware, District of Columbia, Maryland, and Virginia	1,056,380	58,700	2,900	54,625	861,275	82,450	10,850	45,800
Pennsylvania	29,975,445	25,450	23,025	254,505	27,487,436	1,250	10,108	142,936
West Virginia	10,355,335		114,800	316,000	9,032,907		82,842	171,638
Group 4. Florida, Georgia, North Carolina, and South Carolina	27,350	125		40,219	22,200	900	1,000	13,778
Group 5. Indiana and Kentucky	2,614,560	800	1,050	205,855	2,741,687		1,100	213,138
Illinois	3,413,653		40,700	400,275	3,254,205	21,600		474,350
Ohio	56,275	1,900	4,900	72,425	44,850		5,000	116,900
Group 6. Alabama, Mississippi, and Tennessee	5,837,375	27,800	25,650	51,700	5,236,675	60,925	6,700	98,550
Group 7. Michigan, Minnesota, and Wisconsin		6,050	2,000	40,200	2,200	14,950	100	22,630
Group 8. Iowa, Kansas, Missouri, and Nebraska	103,100	92,650	12,100	24,675	171,770	95,350	37,500	23,850
Group 9. Arkansas, Louisiana, Oklahoma, and Texas	210,349	125,950	21,250	414,906	169,431	94,750	11,550	280,800
Group 10. Montana, North Dakota, South Dakota, and Wyoming	393,187	59,850		200,450	920,170	44,900	9,820	57,560
Group 11. Colorado, New Mexico, and Utah	2,071,450	147,050	21,450	86,650	1,773,795	62,945	14,100	112,850
Group 12. Alaska, Idaho, Oregon, and Washington	692,050	5,100	50,700	267,620	428,600	3,000	44,000	410,830
Group 13. Arizona, California, and Nevada	200	30,500	2,000	25,000				17,400
Total (pounds)	56,806,709	783,475	324,225	2,456,905	52,147,201	514,870	264,920	2,207,160
Grand total (pounds)	**60,371,314**				**55,134,151**			

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EXPLOSIVES IN COAL MINING

In the United States the mining industry consumes a larger quantity of explosives than any other single industry. About 86 per cent of all of the black blasting powder sold in 1924 was used in mining; nearly 96 per cent of all permissible explosives were so used, and more than 51 per cent of high explosives other than permissibles. If stone quarries were included, the figure for high explosives would be increased to perhaps 68 per cent.

Most of the black powder and permissible explosives are used in coal mines; relatively small quantities find their way into metal or other mines. Of high explosives other than permissibles, the metal mines and stone quarries are the principal consumers, although large quantities are also used in the anthracite or hard-coal mines; small quantities are used at bituminous coal mines.

Bituminous coal mines in 1924 used 165,543,000 pounds of all classes of explosives. This quantity represented 342 pounds of explosives for each thousand tons of coal produced. Of the 342 pounds of explosives, 73 pounds were permissibles, 20 pounds were other high explosives, and 249 pounds were black powder. It will thus be seen that permissibles constituted about 20 per cent or one-fifth of the total quantity of all explosives used in mining bituminous coal. Eight years ago, in 1917, permissibles formed only 11 per cent of the total quantity of explosives used. (Fig. 1. To get the consumption per thousand tons of coal, add the consumption of the three classes of explosives.)

Anthracite mining in 1924 used 63,837,117 pounds of explosives; this quantity represented 709 pounds of all classes of explosives per thousand tons of coal produced. Of the 709 pounds of explosives per thousand tons of coal mined, 188 pounds were permissibles, 298 pounds were other high explosives, and 223 pounds were black blasting powder. Permissible explosives, therefore, represented nearly 27 per cent of all explosives used by anthracite mines in 1924, as compared with a little over 12 per cent in 1917. (Fig. 1.)

The increasing use of permissibles instead of other types of explosives for coal mining is encouraging to persons interested in mine safety. Although explosives are not one of the major causes of accidents in coal mines, they constitute a hazard. Hence it is gratifying to note that permissibles are replacing other types of explosives, particularly in gaseous or dusty coal mines where explosives not of the permissible types may cause terrible disaster. About 4 out of 10 of the more disastrous explosions in the United States have been caused by ignition of gas or dust by explosives.

Table 8 shows the relative quantities of permissibles, other high explosives, and black powder used for each thousand tons of coal produced in the various States. The figures in the table cover a period of eight years because a single year's consumption of explosives in some of the States might not represent usual conditions. Utah, New

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Mexico, Alabama, Pennsylvania (bituminous), Washington, West Virginia, and Colorado have led all other States in the use of permissibles instead of other types of explosives.

States using the largest quantities of explosives in proportion to total output of coal during the past eight years were Kansas, Georgia, Arkansas, Iowa, and Alaska.

The smallest consumption of explosives in proportion to coal production was in Pennsylvania (bituminous), New Mexico, Colorado, Utah, and West Virginia. All five of these States are among those using the highest percentage of permissibles as compared with other classes of explosives.

TABLE 5.—*Yearly sales of explosives to coal mines compared with yearly production of coal*

Year	Production of coal (short tons)	Pounds of explosives sold to coal mines			Pounds of explosives used per 1,000 tons of coal mined [1]			
		Permissible explosives	High explosives	Black powder	Permissible explosives	High explosives	Black powder	Total
ALL COAL MINES								
1901	293, 299, 816							
1902	301, 590, 434	11, 300						
1903	357, 356, 416	288, 661			1			
1904	351, 816, 398	608, 270			2			
1905	392, 722, 635	1, 031, 300			3			
1906	414, 157, 278	1, 533, 575			4			
1907	480, 363, 424	2, 095, 244			4			
1908	415, 842, 698	2, 108, 610			5			
1909	460, 814, 616	8, 942, 857			19			
1910	501, 596, 378	11, 820, 836			24			
1911	496, 371, 126	13, 428, 239			27			
1912	534, 466, 580	18, 150, 618	20, 903, 430	187, 091, 000	34	39	350	423
1913	570, 048, 125	21, 804, 285	24, 143, 133	184, 917, 075	38	42	325	405
1914	513, 525, 477	19, 593, 892	24, 215, 945	176, 812, 650	38	47	345	430
1915	531, 619, 487	21, 841, 659	22, 384, 025	167, 513, 950	41	42	315	398
1916	590, 098, 175	26, 566, 521	20, 901, 405	176, 976, 025	45	35	300	380
1917	651, 402, 374	32, 910, 397	28, 262, 807	235, 750, 300	51	43	362	456
1918	678, 211, 904	37, 262, 915	31, 368, 073	216, 221, 550	55	46	319	420
1919	553, 952, 259	32, 840, 196	29, 616, 383	153, 490, 125	59	53	277	389
1920	658, 264, 932	45, 222, 130	37, 273, 255	219, 762, 625	69	56	334	459
1921	506, 395, 401	38, 055, 650	34, 231, 542	140, 335, 875	75	68	277	420
1922	476, 951, 121	40, 197, 939	25, 497, 758	154, 761, 950	84	53	324	461
1923	657, 495, 926	56, 806, 709	37, 828, 979	175, 488, 750	86	58	267	411
1924	[2] 573, 280, 000	52, 147, 201	36, 608, 067	140, 625, 050	91	64	245	400
ANTHRACITE MINES								
1917	99, 611, 811	7, 298, 925	16, 074, 125	35, 769, 225	73	162	359	594
1918	98, 826, 084	7, 654, 250	16, 709, 256	30, 301, 800	77	169	307	553
1919	88, 092, 201	8, 579, 643	17, 800, 259	25, 467, 125	98	202	289	589
1920	89, 598, 249	8, 558, 690	19, 278, 375	23, 085, 575	95	215	258	568
1921	90, 473, 451	11, 921, 675	22, 832, 825	23, 861, 275	132	252	264	648
1922	54, 683, 022	7, 197, 596	12, 480, 611	12, 625, 300	132	228	231	591
1923	93, 339, 009	14, 597, 560	25, 539, 570	21, 743, 550	156	274	233	663
1924	[2] 90, 000, 000	16, 895, 771	26, 846, 846	20, 094, 500	188	298	223	709

[1] The figures show the relation that the consumption of each class of explosives bears to the total quantity of explosives used in producing coal; they do not indicate the quantity of coal broken down by any given quantity of explosives. The figures are the quotient obtained by dividing the total quantity of explosives used at all coal mines by the number of tons of coal produced at all mines in the United States.

[2] Estimated.

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TABLE 5.—*Yearly sales of explosives to coal mines compared with yearly production of coal*—Continued

Year	Production of coal (short tons)	Pounds of explosives sold to coal mines			Pounds of explosives used per 1,000 tons of coal mined			
		Permissible explosives	High explosives	Black power	Permissible explosives	High explosives	Black powder	Total
BITUMINOUS COAL MINES								
1917	551,790,563	25,611,472	12,188,682	199,981,075	47	22	362	431
1918	579,385,820	29,608,665	14,658,817	185,919,750	51	25	321	397
1919	465,860,058	24,260,553	11,816,124	128,023,000	52	25	275	352
1920	568,666,683	36,663,440	17,994,880	196,677,050	64	32	346	442
1921	415,921,950	26,133,975	11,398,717	116,474,600	63	27	280	370
1922	422,268,099	33,000,343	13,017,147	142,136,650	78	31	337	446
1923	564,156,917	42,209,149	12,289,409	153,745,200	75	22	272	369
1924	[1] 483,280,000	35,251,430	9,761,221	120,530,550	73	20	249	342

[1] Estimated.

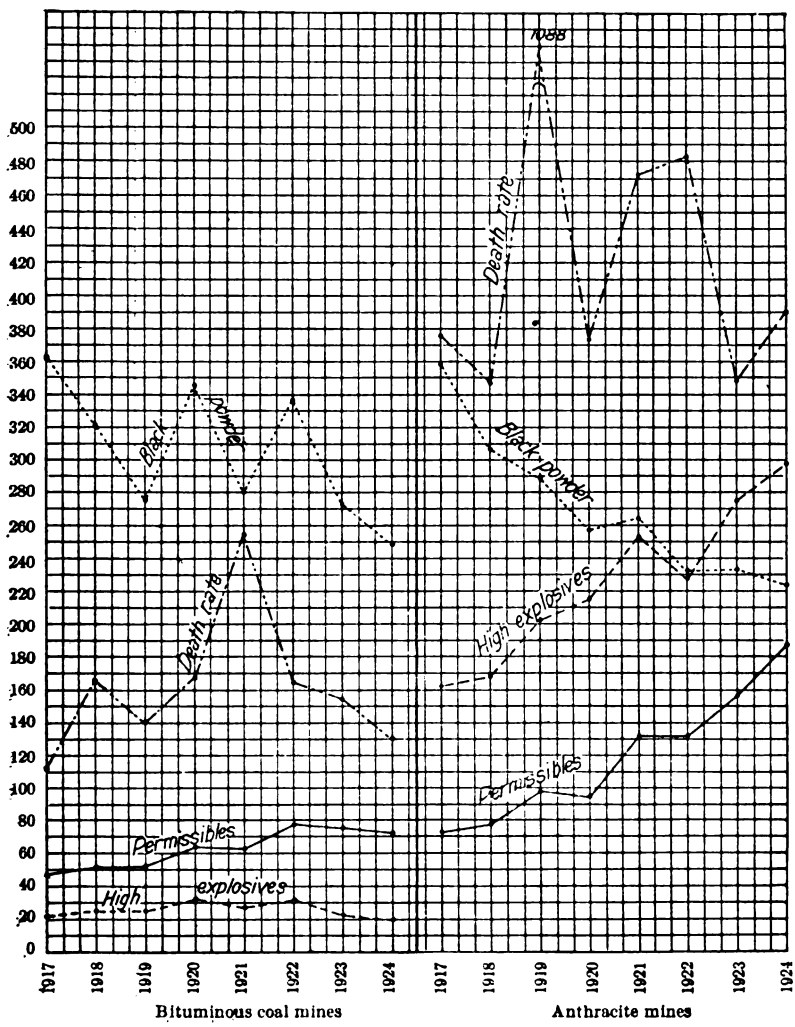

FIG. 1.—Pounds of explosives used per 1,000 tons of coal produced, showing relative quantities of each explosive; also, number of deaths from explosives accidents per million 300-day workers, underground and surface

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TABLE 6.—*Quantity of explosives used in the different coal fields in the United States*

Coal fields and regions [1]	Black blasting powder (kegs)							High explosives other than permissible (pounds)						
	1918	1919	1920	1921	1922	1923	1924	1918	1919	1920	1921	1922	1923	1924
1. Pennsylvania anthracite field	1,212,172	1,018,685	923,423	954,451	505,012	869,742	803,780	16,709,256	17,800,259	19,278,375	22,832,825	12,480,611	25,539,570	26,846,846
2. Northern Appalachian region [2]	1,967,012	1,529,511	2,271,648	1,086,831	1,671,186	1,762,666	1,358,765	5,320,401	4,561,368	6,975,482	4,828,967	6,057,130	5,559,409	4,302,867
3. Southern Appalachian region	815,785	656,037	1,050,068	623,094	1,065,868	905,702	730,301	2,202,700	1,867,150	3,221,212	1,971,317	2,045,550	2,230,206	1,594,900
4. Eastern interior field	3,034,820	1,876,849	3,037,925	2,054,752	1,937,438	2,321,786	1,708,789	1,121,958	904,826	1,360,150	1,063,702	938,091	1,172,339	1,324,044
5. Western interior field	1,319,401	838,599	1,186,280	669,789	718,280	853,440	786,028	4,067,393	3,642,960	4,778,831	2,680,231	2,431,266	2,159,020	1,621,665
6. Rocky Mountain region	279,039	206,099	294,657	198,315	271,053	286,178	221,105	1,347,240	596,170	847,009	635,050	675,310	1,025,285	710,845
7. Pacific coast region	20,633	13,825	26,504	26,203	21,641	20,036	16,234	599,125	243,650	812,196	219,450	869,800	143,150	206,900
Total	**8,648,862**	**6,139,605**	**8,790,505**	**5,613,435**	**6,190,478**	**7,019,550**	**5,625,002**	**31,368,073**	**29,616,383**	**37,273,255**	**34,231,542**	**25,497,758**	**37,828,979**	**36,608,067**

Coal fields and regions [1]	Permissible explosives (pounds)													
	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
1. Pennsylvania anthracite field	2,177,172	3,294,225	4,380,635	5,037,050	5,219,032	7,298,925	7,654,250	8,579,643	8,558,690	11,921,675	7,197,596	14,597,560	16,895,771
2. Northern Appalachian region [2]	9,190,025	9,744,810	7,966,464	9,435,318	12,147,207	14,505,542	17,007,369	14,626,371	22,489,169	15,652,147	19,953,744	26,845,875	20,530,697
3. Southern Appalachian region	3,995,485	4,481,975	3,510,013	3,447,964	4,386,757	5,287,755	5,764,886	4,210,184	5,573,168	3,809,408	6,289,282	7,648,185	7,200,450
4. Eastern interior field	751,005	2,058,075	1,364,450	1,631,775	1,949,925	2,403,600	2,873,846	2,542,290	3,906,872	3,582,217	3,222,100	4,244,753	4,056,517
5. Western interior field	440,825	377,625	411,937	433,010	422,425	624,045	930,444	642,938	1,187,171	493,378	514,803	313,449	341,201
6. Rocky Mountain region	1,473,129	1,634,575	1,796,750	1,710,992	2,244,275	2,423,180	2,622,520	1,882,770	2,744,360	1,854,800	2,454,929	2,464,637	2,693,965
7. Pacific coast region	122,977	213,000	163,643	145,550	196,900	367,350	409,600	356,000	762,700	742,025	565,485	692,250	428,600
Total	**18,150,618**	**21,804,285**	**19,593,892**	**21,841,659**	**26,566,521**	**32,910,397**	**37,262,915**	**32,840,196**	**45,222,130**	**38,055,650**	**40,197,939**	**56,806,709**	**52,147,201**

[1] The various coal fields include the following States: Group 1 includes the Pennsylvania anthracite field only; Group 2 includes Pennsylvania bituminous, Maryland, West Virginia, Ohio, and Virginia; Group 3 includes Alabama, Georgia, North Carolina, Tennessee, and Kentucky; Group 4 includes Illinois, Indiana, and Michigan; Group 5 includes Iowa, Missouri, Arkansas, Texas, Oklahoma, and Kansas; Group 6 includes Colorado, Idaho, North Dakota, Montana, Utah, Wyoming, Nevada, South Dakota, and New Mexico; and Group 7 includes Alaska, California, Oregon, and Washington.

[2] Not including Pennsylvania anthracite field.

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TABLE 7.—*Quantity of coal mined in different coal fields in the United States*

Coal fields and regions	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923
1. Pennsylvania anthracite field	91, 524, 022	90, 821, 507	88, 995, 061	87, 578, 493	99, 611, 811	98, 826, 084	88, 092, 201	89, 598, 240	90, 473, 451	54, 683, 022	93, 339, 000
2. Northern appalachian region[1]	294, 808, 633	250, 627, 117	269, 876, 970	305, 651, 290	314, 471, 558	329, 086, 628	278, 019, 905	321, 900, 590	230, 063, 832	232, 304, 172	334, 323, 866
3. Southern Appalachian region	44, 454, 532	42, 085, 941	42, 154, 468	49, 791, 197	54, 189, 294	57, 696, 763	50, 846, 313	58, 706, 985	48, 674, 748	65, 474, 895	71, 386, 873
4. Eastern interior field	80, 016, 201	75, 513, 359	76, 991, 866	87, 469, 224	114, 113, 521	121, 434, 557	82, 771, 441	119, 585, 243	91, 063, 087	78, 530, 015	106, 711, 249
5. Western interior field	27, 575, 292	26, 396, 916	25, 684, 804	26, 474, 830	30, 707, 592	30, 723, 823	21, 741, 003	27, 677, 788	17, 112, 893	15, 233, 645	18, 518, 549
6. Rocky Mountain region	27, 327, 452	24, 950, 285	25, 434, 089	30, 031, 648	34, 209, 991	36, 266, 503	29, 411, 536	36, 972, 403	26, 462, 106	28, 038, 039	30, 100, 096
7. Pacific coast region	3, 951, 093	3, 130, 352	2, 492, 229	3, 101, 493	4, 098, 607	4, 177, 546	3, 069, 860	3, 841, 674	2, 544, 384	2, 687, 333	3, 066, 284
Total	570, 048, 125	513, 525, 477	531, 619, 487	590, 098, 176	651, 402, 374	678, 211, 904	553, 952, 259	658, 964, 923	506, 395, 401	476, 951, 121	657, 495, 926

[1] Not including Pennsylvania anthracite field.

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TABLE 8.—*Consumption of explosives at coal mines per 1,000 tons of coal produced by States, during the 8-year period 1917–1924*

States	Production of coal, 8-year total, 1917–1924, tons	Pounds of explosives used				Pounds per 1,000 tons of coal				Per cent			
		Black blasting powder	Permissible explosives	High explosives other than permissible	Total	Black blasting powder	Permissible explosives	High explosives other than permissible	Total	Black blasting powder	Permissible explosives	High explosives other than permissible	Total
Alabama	140,635,144	28,447,650	32,198,859	9,652,537	70,299,046	202	229	69	500	40.4	45.8	13.8	100.00
Alaska	[1] 647,097	50,250	141,900	499,650	691,800	78	219	772	1,069	7.3	20.5	72.2	100.00
Arkansas	12,938,279	15,566,850	525,046	743,185	16,835,081	1,203	41	57	1,301	92.5	3.1	4.4	100.00
California, Idaho, Nevada	[1] 36,313	6,225	5,800	5,850	17,875	171	160	161	492	34.8	32.5	32.7	100.00
Colorado	87,281,127	12,879,150	5,347,784	1,411,970	19,638,904	148	61	16	225	65.8	27.1	7.1	100.00
Georgia and North Carolina	[1] 712,751	654,725	59,900	383,425	1,098,050	919	84	538	1,541	59.6	5.5	34.9	100.00
Illinois	616,458,567	298,322,600	23,029,829	3,757,633	325,110,062	484	37	6	527	91.9	7.0	1.1	100.00
Indiana	200,162,333	173,229,425	3,799,416	4,432,807	181,461,648	866	19	22	907	95.5	2.1	2.4	100.00
Iowa	51,673,921	57,366,575	108,800	3,494,552	60,969,927	1,110	2	68	1,180	94.0	.2	5.8	100.00
Kansas	40,855,269	68,639,625	391,331	15,714,606	84,745,562	1,680	9	385	2,074	81.0	.4	18.6	100.00
Kentucky	284,647,173	114,241,600	10,909,803	4,425,412	129,576,815	401	38	16	455	88.1	8.4	3.5	100.00
Maryland	24,366,519	5,888,050	774,155	1,144,291	7,806,496	241	32	47	320	75.3	10.0	14.7	100.00
Michigan	9,769,113	2,130,075	2,450	688,836	2,821,361	218	-------	71	289	75.4	---------	24.6	100.00
Missouri	34,367,164	25,507,400	42,475	1,684,145	27,234,020	742	1	49	792	93.7	.1	6.2	100.00
Montana	28,168,286	15,026,575	115,400	850,170	15,992,145	534	4	30	568	94.0	.7	5.3	100.00
New Mexico	26,061,790	925,575	3,781,675	552,175	5,259,425	36	145	21	202	17.8	71.8	10.4	100.00
North Dakota	7,827,732	4,837,875	126,225	1,583,514	6,547,614	618	16	202	836	73.9	1.9	24.2	100.00
Ohio	307,759,560	91,303,675	191,370	6,080,883	97,575,928	297	-------	20	317	93.7	---------	6.3	100.00
Oklahoma	30,451,864	23,618,550	3,931,277	1,195,330	28,745,157	776	129	39	944	82.2	13.7	4.1	100.00
Oregon	[1] 179,732	35,275	10,250	55,050	100,575	196	57	307	560	35.0	10.2	54.8	100.00
Pennsylvania, bituminous	1,233,407,047	120,138,050	86,946,949	21,624,008	228,709,007	97	70	18	185	52.4	37.9	9.7	100.00
South Dakota	[1] 76,562	53,275	500	12,075	65,850	696	6	158	860	80.9	.7	18.4	100.00
Tennessee	46,378,270	23,966,225	2,614,756	2,190,895	28,771,876	517	56	47	620	83.4	9.0	7.6	100.00
Texas	12,278,796	5,554,200	48,500	1,734,838	7,337,538	453	4	141	598	75.7	.7	23.6	100.00
Utah	38,289,586	1,332,125	6,668,775	1,038,900	9,039,800	35	174	27	236	14.8	73.7	11.5	100.00
Virginia	81,827,530	18,804,700	4,364,651	3,721,376	26,890,727	230	53	46	329	69.9	16.1	14.0	100.00
Washington	25,725,933	4,140,325	4,166,060	3,276,671	11,583,056	161	162	127	450	35.8	36.0	28.2	100.00
West Virginia	706,659,895	114,363,575	59,333,789	9,627,613	183,324,977	162	84	13	259	62.6	32.4	5.0	100.00
Wyoming	63,811,737	16,470,175	3,100,802	1,542,600	21,113,577	258	49	24	331	77.9	14.8	7.3	100.00
Total bituminous	4,113,450,090	1,243,500,375	252,738,527	103,124,907	1,599,363,809	302	62	25	389	77.6	16.0	6.4	100.00
Pennsylvania, anthracite	710,067,827	192,935,850	82,704,110	157,561,867	433,201,827	272	116	222	610	44.6	19.0	36.4	100.00
Grand total	4,823,517,917	1,436,436,225	[2] 335,443,137	260,686,864	[2] 2,032,566,226	298	69	54	421	70.8	16.4	12.8	100.00

[1] Coal production partly estimated.

[2] Includes 500 pounds reported sold for coal mining in Wisconsin. There are no coal mines in Wisconsin.

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TABLE 9.—*Quantity of explosives used in* ***coal mining*** *during the years 1922, 1923, and 1924, by States and kinds of explosives*

States	1922			1923			1924		
	Black blasting powder	High explosives other than permissible	Permissible explosives	Black blasting powder	High explosives other than permissible	Permissible explosives	Black blasting powder	High explosives other than permissible	Permissible explosives
	Kegs	*Pounds*	*Pounds*	*Kegs*	*Pounds*	*Pounds*	*Kegs*	*Pounds*	*Pounds*
Alabama	165,127	1,161,400	4,204,407	136,688	1,065,436	5,249,525	116,412	722,775	4,875,825
Arkansas	46,266	166,824	30,950	59,330	70,700	9,800	62,005	49,600	13,050
Colorado	70,308	149,910	790,829	64,558	309,235	795,400	66,421	279,845	700,950
Illinois	1,146,730	205,805	2,750,125	1,471,983	319,475	3,413,653	1,080,849	415,188	3,254,205
Indiana	782,984	649,936	471,975	840,412	783,389	831,100	623,013	856,706	800,112
Iowa	223,658	270,050	19,450	296,436	341,125	49,750	257,556	220,000	33,450
Kansas	224,592	1,360,562	67,800	299,722	1,533,970	52,550	310,432	1,186,790	134,350
Kentucky	778,423	561,650	1,708,950	640,028	794,200	1,783,460	527,177	690,775	1,941,575
Maryland	20,337	85,638	186,650	25,999	139,350	163,630	19,980	140,567	82,300
Michigan	7,724	82,350		9,391	69,475		4,927	52,150	2,200
Missouri	96,961	152,350	3,100	103,673	107,125	800	68,708	104,025	3,970
Montana	85,531	35,075	17,850	94,537	31,525	12,350	70,267	82,025	7,400
New Mexico	5,252	30,125	472,200	3,110	28,250	430,750	5,530	27,200	362,650
North Dakota	31,845	292,950	37,700	40,007	193,125	28,975	29,862	141,075	54,400
Ohio	452,154	1,065,768	4,050	500,995	1,128,008	56,275	319,241	466,898	44,850
Oklahoma	98,018	136,105	369,803	72,391	77,400	200,499	73,002	55,750	156,381
Pennsylvania, bituminous	574,030	3,489,826	10,950,126	585,984	2,178,331	15,377,885	456,854	1,849,340	10,591,665
Tennessee	119,539	282,500	368,225	123,922	314,520	587,850	82,642	127,125	360,850
Texas	28,785	345,375	23,700	21,888	28,700	50	14,325	5,500	
Utah	4,964	122,700	842,050	4,260	257,200	845,300		110,150	710,195
Virginia	101,462	458,850	597,950	97,637	574,750	892,750	65,581	347,451	778,975
Washington	19,754	817,750	518,935	19,917	103,250	624,850	15,319	129,900	426,600
West Virginia	523,203	957,048	8,214,968	552,051	1,538,970	10,355,335	497,109	1,498,611	9,032,907
Wyoming	73,143	40,650	294,300	79,686	205,950	351,362	49,025	70,550	858,370
Other States	4,676	95,950	54,250	5,203	90,950	95,250	4,985	131,225	24,200
Total	5,685,466	13,017,147	33,000,343	6,149,808	12,289,409	42,209,149	4,821,222	9,761,221	35,251,430
Pennsylvania anthracite	505,012	12,480,611	7,197,596	869,742	25,539,570	14,597,560	803,780	26,846,846	16,895,771
Grand total	**6,190,478**	**25,497,758**	**40,197,939**	**7,019,550**	**37,828,979**	**56,806,709**	**5,625,002**	**36,608,067**	**52,147,201**

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DISTRIBUTION OF EXPLOSIVES, BY STATES, 1917–1924

Tables 10, 11, and 12 show the distribution, by States, of the sales of black powder, high explosives, and permissibles, and the classes of work in which the explosives were used, during the eight-year period 1917–1924.

TABLE 10.—*Amount of* ***black blasting powder*** *used in the United States during the eight-year period 1917–1924, classified by use*

[Kegs of 25 pounds each]

State	Quantity used for coal mining	Quantity used for other mining	Quantity used for railway and other construction work	Quantity used for all other purposes	Total
	Kegs	*Kegs*	*Kegs*	*Kegs*	*Kegs*
Alabama	1,137,906	65,815	75,100	67,492	1,346,313
Alaska	2,010	924	90,642	636	94,212
Arizona		86,644	103,226	44,417	234,287
Arkansas	622,674	26,065	18,070	11,894	678,703
California	249	13,528	477,339	460,985	952,101
Colorado	515,166	34,626	28,230	146,537	724,559
Connecticut		47	606	4,373	5,026
Delaware			381	399	780
Florida		5,219	3,236	14,460	22,915
Georgia	24,852	20,980	49,987	30,856	126,675
Idaho		2,189	66,018	39,372	107,579
Illinois	11,932,904	36,077	15,378	283,585	12,267,944
Indiana	6,929,177	6,452	8,271	161,572	7,105,472
Iowa	2,294,663	22,166	3,246	112,388	2,432,463
Kansas	2,745,585	5,376	31,948	83,423	2,866,332
Kentucky	4,569,664	43,477	106,059	332,547	5,051,747
Louisiana			283	1,754	2,037
Maine		20	141	15,779	15,940
Maryland	235,522	210	6,307	21,748	263,787
Massachusetts		2	404	23,329	23,735
Michigan	85,203	28,260	1,369	3,507	118,339
Minnesota		950,591	9,103	19,250	978,944
Mississippi			2,246	16,290	18,536
Missouri	1,020,296	51,350	51,055	199,051	1,321,752
Montana	601,063	43,887	55,094	138,510	838,554
Nebraska		1,350	7,394	14,291	23,035
Nevada		163,523	8,583	12,124	184,230
New Hampshire		75	16	3,403	3,494
New Jersey			1,741	12,539	14,280
New Mexico	37,023	31,634	29,067	23,134	120,858
New York		16,679	4,554	90,589	111,822
North Carolina	1,337	7,826	118,663	48,451	176,277
North Dakota	193,515	410	3,967	60,453	258,345
Ohio	3,652,147	108,277	17,727	272,309	4,050,460
Oklahoma	944,742	3,545	44,218	67,076	1,059,581
Oregon	1,411	671	179,379	72,308	253,769
Pennsylvania (Anthracite)	7,717,434	42,262	113,789	1,248,547	13,927,554
Pennsylvania (Bituminous)	4,805,522				
Rhode Island			23	1,761	1,784
South Carolina		655	12,708	5,914	19,277
South Dakota	2,131	4,836	813	9,303	17,083
Tennessee	958,649	28,768	59,977	110,905	1,158,299
Texas	222,168	6,755	57,506	113,137	399,566
Utah	53,285	16,078	76,662	28,388	174,413
Vermont		642	21	32,198	32,861
Virginia	752,188	7,664	50,619	47,323	857,794
Washington	165,613	5,287	117,500	84,306	372,706
West Virginia	4,574,543	15,017	147,298	186,731	4,923,589
Wisconsin		2,037	1,408	21,244	24,689
Wyoming	658,807	39,397	64,475	156,330	919,009
Total	57,457,449	1,947,293	2,331,847	4,956,918	66,693,507

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TABLE 11.—*Amount of* ***high explosives*** *used in the United States during the eight-year period 1917–1924, classified by use*

State	Quantity used for coal mining	Quantity used for other mining	Quantity used for railway and other construction work	Quantity used for all other purposes	Total
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Alabama	9,652,537	31,180,438	2,538,583	7,583,290	50,954,848
Alaska	499,650	18,775,005	2,343,450	801,745	22,419,850
Arizona		77,291,871	1,751,550	4,447,072	83,490,493
Arkansas	743,185	2,338,169	4,223,009	6,200,265	13,504,628
California	5,850	28,056,626	24,666,644	56,309,024	109,038,144
Colorado	1,411,970	17,512,040	1,291,148	16,511,161	36,726,319
Connecticut		22,100	1,278,382	3,871,040	5,171,522
Delaware			152,846	321,787	474,633
Florida		4,829,888	4,886,474	11,557,973	21,274,335
Georgia	269,150	729,837	1,855,020	4,457,756	7,311,763
Idaho		19,621,735	2,498,240	7,781,635	29,901,610
Illinois	3,757,633	13,594,038	3,392,410	22,133,400	42,877,481
Indiana	4,432,807	229,505	1,407,560	13,627,608	19,697,480
Iowa	3,494,552	1,844,100	1,015,035	9,790,692	16,144,379
Kansas	15,714,606	20,977,792	1,444,731	7,396,488	45,533,617
Kentucky	4,425,412	1,372,151	7,431,523	7,623,148	20,852,234
Louisiana		207,000	1,906,400	6,239,584	8,352,984
Maine		16,900	327,644	4,164,098	4,508,642
Maryland	1,144,291	386,875	1,441,676	8,238,399	11,211,241
Massachusetts		41,025	1,521,367	3,744,904	5,307,296
Michigan	688,836	131,814,760	2,382,415	27,158,969	162,044,980
Minnesota		71,560,946	2,340,554	11,503,017	85,404,517
Mississippi		2,250	2,943,525	3,181,360	6,127,135
Missouri	1,684,145	53,604,070	4,082,914	15,327,545	74,698,674
Montana	850,170	38,325,899	1,642,584	6,392,732	47,211,385
Nebraska			303,250	1,208,689	1,511,939
Nevada		23,014,340	371,935	7,483,145	30,869,420
New Hampshire		125,072	178,370	973,582	1,277,024
New Jersey		9,136,962	1,079,385	7,686,816	17,903,163
New Mexico	552,175	16,386,804	587,300	1,590,680	19,116,959
New York		25,463,975	14,464,495	29,390,717	69,319,187
North Carolina	114,275	1,727,450	6,241,738	8,816,206	16,899,669
North Dakota	1,583,514	30,650	47,250	781,206	2,442,620
Ohio	6,080,883	2,857,546	5,772,934	40,889,546	55,600,909
Oklahoma	1,195,330	67,461,973	2,410,650	7,456,309	78,524,262
Oregon	55,050	1,237,765	11,595,633	20,702,898	33,591,346
Pennsylvania (Anthracite)	157,561,867	3,928,267	10,114,244	112,994,726	306,223,112
Pennsylvania (Bituminous)	21,624,008				
Rhode Island		5,700	798,838	504,587	1,309,125
South Carolina		33,825	1,225,435	2,264,620	3,523,880
South Dakota	12,075	8,432,603	132,640	1,328,786	9,906,104
Tennessee	2,190,895	7,989,623	5,056,766	7,455,267	22,692,551
Texas	1,734,838	2,148,360	1,903,036	10,004,370	15,790,604
Utah	1,038,900	24,715,573	1,395,450	7,892,443	35,042,366
Vermont		218,250	1,054,575	2,022,299	3,295,124
Virginia	3,721,376	2,964,725	5,937,654	11,516,925	24,140,680
Washington	3,276,671	1,524,410	11,627,052	40,095,651	56,523,784
West Virginia	9,627,613	162,275	8,264,750	16,305,565	34,360,203
Wisconsin		15,780,085	1,214,741	24,811,287	41,806,113
Wyoming	1,542,600	1,700,400	1,096,970	1,019,409	5,359,379
Total	**280,686,864**	**751,381,653**	**173,640,775**	**631,560,421**	**1,817,269,713**

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TABLE 12.—*Amount of* ***permissible explosives*** *used in the United States during the eight-year period 1917–1924, classified by use*

State	Quantity used for coal mining	Quantity used for other mining	Quantity used for railway and other construction work	Quantity used for all other purposes	Total
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Alabama	32,198,850	427,332	35,518	299,612	32,961,312
Alaska	141,900	48,350	74,100	104,225	368,575
Arizona		451,200		68,750	519,950
Arkansas	525,046	14,700	36,904	292,848	869,498
California	5,800	32,360	6,650	63,685	108,495
Colorado	5,347,784	95,700	20,025	1,116,655	6,580,164
Connecticut		750	25,000	650	26,400
Delaware				1,700	1,700
Florida		237,975	1,350	91,110	330,435
Georgia	100	2,100	1,000	581,712	584,912
Idaho		7,400	11,300	24,820	43,520
Illinois	23,029,829	190,475	46,750	992,040	24,259,094
Indiana	3,799,416	13,200	4,575	480,338	4,297,529
Iowa	108,800	61,820	1,400	24,675	196,695
Kansas	391,331	203,350	3,100	222,038	909,819
Kentucky	10,909,803	62,125	28,513	621,605	11,622,046
Louisiana		61,450	6,900	1,025,701	1,094,051
Maine				100	100
Maryland	774,155	37,050	2,000	211,575	1,024,780
Massachusetts			250	16,400	16,650
Michigan	2,450	206,750	100	145,330	354,630
Minnesota		6,150	200	800	7,150
Mississippi			37,000	143,890	180,890
Missouri	42,475	167,200	76,575	956,284	1,242,534
Montana	115,400	218,230	10,670	19,810	364,110
Nebraska			100	5,947	6,047
Nevada		5,250		7,700	12,950
New Hampshire		1,000	1,550		2,550
New Jersey		700	600	35,625	36,925
New Mexico	3,781,675	504,250	31,350	97,400	4,414,675
New York		3,389,715	4,600	134,625	3,528,940
North Carolina	59,800	3,250	2,000	10,450	75,500
North Dakota	126,225		4,925	3,500	134,650
Ohio	191,370	26,700	28,600	672,152	918,822
Oklahoma	3,931,277	699,600	37,862	367,246	5,035,985
Oregon	10,250	250	38,550	213,720	262,770
Pennsylvania (Anthracite)	82,704,110	101,100	167,835	8,034,647	177,954,841
Pennsylvania (Bituminous)	86,946,949				
Rhode Island			2,000		2,000
South Carolina				3,240	3,240
South Dakota	500	11,650			12,150
Tennessee	2,614,756	499,300	68,000	201,605	3,383,661
Texas	48,500	262,900	21,400	655,978	988,778
Utah	6,668,775	11,566,295	179,050	533,130	18,947,250
Vermont				2,650	2,650
Virginia	4,364,651	347,400	44,950	339,475	5,096,476
Washington	4,166,060	118,600	117,710	582,575	4,984,945
West Virginia	59,333,789	138,750	562,263	3,843,330	63,878,132
Wisconsin	[1] 500		2,000	132,375	134,875
Wyoming	3,100,802	221,250		867,000	4,189,052
Total	**335,443,137**	**90,683,627**	**1,745,225**	**24,850,723**	**381,972,713**

[1] Erroneously reported for coal mining; there is no coal mined in Wisconsin.

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TABLE 13.—*Percentage of explosives used for various purposes in the United States during the years 1915 to 1924*

	Coal mining	Other mining	Railway and other construction work	All other purposes	Total
1924	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Black blasting powder	84.2	2.1	5.1	8.6	100.00
High explosives	13.4	38.0	14.9	33.7	100.00
Permissible	94.6	.9	.5	4.0	100.00
Total	**46.3**	**21.8**	**10.0**	**21.9**	**100.00**
1923					
Black blasting powder	86.9	2.2	4.6	6.3	100.00
High explosives	14.2	39.3	11.9	34.6	100.00
Permissible explosives	94.1	1.3	.5	4.1	100.00
Total	**51.0**	**20.8**	**7.8**	**20.4**	**100.00**
1922					
Black blasting powder	86.5	2.4	4.3	6.8	100.00
High explosives	12.2	37.3	10.7	39.8	100.00
Permissible explosives	92.6	3.3	.4	3.7	100.00
Total	**51.1**	**19.4**	**7.0**	**22.5**	**100.00**
1921					
Black blasting powder	87.7	2.9	2.5	6.9	100.00
High explosives	20.0	29.8	10.7	39.5	100.00
Permissible explosives	92.5	2.1	.7	4.7	100.00
Total	**57.1**	**15.2**	**6.1**	**21.6**	**100.00**
1920					
Black blasting powder	86.2	3.4	1.9	8.5	100.00
High explosives	16.3	38.9	6.6	38.2	100.00
Permissible explosives	83.8	6.9	.5	8.8	100.00
Total	**56.2**	**18.9**	**3.7**	**21.2**	**100.00**
1919					
Black blasting powder	85.0	3.5	2.8	8.7	100.00
High explosives	14.9	45.3	6.4	33.4	100.00
Permissible explosives	84.5	6.4	.5	8.6	100.00
Total	**51.7**	**23.6**	**4.3**	**20.4**	**100.00**
1918					
Black blasting powder	87.7	3.0	2.2	7.1	100.00
High explosives	15.2	49.6	5.8	29.4	100.00
Permissible explosives	80.9	9.9	.4	8.8	100.00
Total	**57.1**	**22.9**	**3.5**	**16.5**	**100.00**
1917					
Black blasting powder	85.1	3.4	4.7	6.8	100.00
High explosives	10.8	50.4	7.8	31.0	100.00
Permissible explosives	76.5	14.2	.2	9.1	100.00
Total	**51.0**	**25.4**	**5.7**	**17.9**	**100.00**
1916					
Black blasting powder	82.1	3.6	5.0	0.3	100.00
High explosives	8.2	51.6	8.6	31.6	100.00
Permissible explosives	76.6	17.9	.3	5.2	100.00
Total	**44.4**	**28.8**	**6.5**	**20.3**	**100.00**
1915					
Black blasting powder	84.8	3.4	3.6	8.2	100.00
High explosives	9.5	46.3	9.4	34.9	100.00
Permissible explosives	79.9	17.1	.5	2.5	100.00
Total	**45.9**	**26.1**	**6.4**	**21.5**	**100.00**

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TABLE 14.—*Production of explosives in the United States from 1914 to 1924*

[Excluding exports]

	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
Black blasting powder (kegs of 25 pounds):											
Quantity used for coal mining	7,072,506	6,700,558	7,079,041	9,430,012	8,648,862	6,139,605	8,790,505	5,613,435	6,190,478	7,019,550	5,625,002
Quantity used for other mining	302,885	268,146	313,851	378,199	297,818	252,134	347,223	184,792	167,700	174,929	144,498
Quantity used for railway and other construction work	316,131	289,869	428,853	516,892	219,260	204,197	196,172	163,688	309,819	370,442	341,377
Quantity used for all other purposes	552,466	650,319	801,256	759,638	700,594	624,506	861,293	438,935	486,652	513,132	572,168
Total	8,243,988	7,908,892	8,623,001	11,084,741	9,866,534	7,220,442	10,195,193	6,400,850	7,154,649	8,078,053	6,683,045
Black blasting powder (pounds):											
Quantity used for coal mining	176,812,650	167,513,950	176,976,025	235,750,300	216,221,550	153,490,125	219,762,625	140,335,875	154,761,950	175,488,750	140,625,050
Quantity used for other mining	7,572,125	6,703,650	7,846,275	9,454,975	7,445,450	6,303,350	8,680,575	4,619,800	4,192,500	4,373,225	3,612,450
Quantity used for railway and other construction work	7,903,275	7,246,725	10,721,325	12,922,300	5,481,500	5,104,925	4,904,300	4,092,200	7,745,475	9,261,050	8,534,425
Quantity used for all other purposes	13,811,650	16,257,975	20,031,400	18,990,950	17,514,850	15,612,650	21,532,325	10,973,375	12,166,300	12,828,300	14,304,200
Total	206,099,700	197,722,300	215,575,025	277,118,525	246,663,350	180,511,050	254,879,825	160,021,250	178,866,225	201,951,325	167,076,125
High explosives other than permissible (pounds):											
Quantity used for coal mining	24,215,945	22,384,025	20,901,405	28,262,807	31,368,073	29,616,383	37,273,255	34,231,542	25,497,758	37,828,979	36,608,067
Quantity used for other mining	84,264,577	109,128,966	131,753,648	132,235,515	102,366,876	89,754,788	89,132,316	50,977,366	78,074,489	105,003,900	103,836,403
Quantity used for railway and other construction work	27,983,946	22,279,699	21,905,376	20,418,227	12,081,541	12,759,623	15,052,608	18,317,333	22,434,206	31,930,021	40,647,216
Quantity used for all other purposes	81,989,503	82,035,897	80,594,358	81,399,531	60,599,587	66,137,794	87,653,905	67,426,161	83,469,631	92,642,320	92,231,492
Total	218,453,971	235,828,587	255,154,787	262,316,080	206,416,077	198,268,588	229,112,084	170,952,402	209,476,084	267,405,220	273,323,178

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Permissible explosives (pounds):											
Quantity used for coal mining	19, 593, 892	21, 841, 659	26, 566, 521	32, 910, 397	37, 262, 915	32, 840, 106	45, 222, 130	38, 055, 650	40, 197, 939	50, 806, 700	52, 147, 201
Quantity used for other mining	4, 850, 241	4, 687, 510	6, 206, 558	6, 102, 225	4, 550, 130	2, 498, 132	3, 750, 585	881, 710	1, 452, 500	783, 475	514, 670
Quantity used for railway and other construction work	281, 425	139, 843	97, 100	106, 185	183, 380	183, 353	266, 505	262, 545	154, 112	324, 225	264, 920
Quantity used for all other purposes	972, 260	660, 807	1, 815, 061	3, 921, 915	4, 048, 808	3, 333, 151	4, 723, 621	1, 933, 946	1, 625, 217	2, 456, 905	2, 207, 160
Total	25, 697, 818	27, 349, 909	34, 685, 240	43, 040, 722	46, 045, 233	38, 854, 832	53, 962, 841	41, 133, 851	43, 429, 768	60, 371, 314	55, 134, 151
Grand total (pounds):											
Quantity used for coal mining	220, 622, 487	211, 739, 634	224, 443, 951	296, 923, 504	284, 852, 538	215, 946, 704	302, 258, 010	212, 623, 067	220, 457, 647	270, 124, 438	229, 380, 318
Quantity used for other mining	96, 686, 943	120, 520, 126	145, 806, 481	147, 792, 715	114, 362, 456	98, 556, 270	101, 563, 476	56, 478, 876	83, 719, 489	110, 160, 600	107, 963, 723
Quantity used for railway and other construction work	36, 168, 646	29, 666, 267	32, 723, 801	33, 446, 712	17, 746, 421	18, 047, 901	20, 223, 413	22, 672, 078	30, 333, 793	41, 515, 296	49, 446, 861
Quantity used for all other purposes	96, 773, 413	98, 974, 769	102, 440, 819	104, 312, 396	82, 163, 245	85, 083, 595	113, 909, 851	80, 333, 482	97, 281, 148	107, 927, 525	108, 742, 852
Total	450, 251, 489	460, 900, 796	505, 415, 052	582, 475, 327	498, 124, 660	417, 634, 470	537, 954, 750	372, 107, 503	431, 792, 077	529, 727, 859	495, 533, 494

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MONTHLY SALES OF EXPLOSIVES

Tables 15 and 16, which show the monthly fluctuations in the sales of explosives during the past five years, are based mainly on monthly reports by manufacturers who are members of the Institute of Makers of Explosives, although the figures for 1922, 1923, and 1924 include some companies not members of the institute. The figures for 1924 are for companies whose sales represented about 97 per cent of all sales of black blasting powder, 94 per cent of high explosives (other than permissibles), and over 99 per cent of permissible explosives. Reports for companies not covered by these figures are received in the form of an annual summary, hence the data for those companies could not be segregated on a monthly basis.

The standard chosen for purposes of comparison was the average monthly sales during the year, and this quantity was rated at 100. The sales for each month were then calculated as a certain percentage of this standard.

Since nearly all the black powder and permissibles used in the United States are consumed at coal mines, the fluctuations in the monthly sales of these two classes of explosives follow closely those in the monthly production of coal.

Table 17 shows the monthly fluctuations of sales of explosives during 1924 with reference to the purposes for which the explosives were used.

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TABLE 15.—*Monthly sales of explosives in 1924, by uses* [1]

[Excluding exports]

	January	February	March	April	May	June	July	August	September	October	November	December
Black blasting powder (kegs of 25 pounds):	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*
Quantity used for coal mining	625,838	558,916	428,542	303,546	319,528	349,945	365,205	427,798	519,575	561,805	492,400	523,960
Quantity used for other mining	11,340	10,241	13,312	14,613	11,847	9,700	14,801	9,321	12,126	9,675	12,740	7,116
Quantity used for railway and other construction work	21,454	23,598	18,974	23,928	36,573	40,637	29,775	26,348	34,099	45,192	3,769	30,351
Quantity used for other purposes	47,472	43,989	45,686	57,289	24,544	45,835	51,359	53,900	65,065	37,022	72,674	32,525
Total	706,104	636,744	506,514	399,376	392,492	446,117	461,140	517,367	630,865	653,694	581,583	593,952
Black blasting powder:	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Quantity used for coal mining	15,645,950	13,972,900	10,713,550	7,588,650	7,988,200	8,748,625	9,130,125	10,694,950	12,989,375	14,045,125	12,310,000	13,099,000
Quantity used for other mining	283,500	256,025	332,800	365,325	296,175	242,500	370,025	233,025	303,150	241,875	318,500	177,900
Quantity used for railway and other construction work	536,350	589,950	474,350	598,200	914,325	1,015,925	744,375	658,700	852,475	1,129,800	94,225	758,775
Quantity used for all other purposes	1,186,800	1,099,725	1,142,150	1,432,225	613,600	1,145,875	1,283,975	1,347,500	1,626,625	925,550	1,816,850	813,125
Total	17,652,600	15,918,600	12,662,850	9,984,400	9,812,300	11,152,925	11,528,500	12,934,175	15,771,625	16,342,350	14,539,575	14,848,800
High explosives other than permissible:												
Quantity used for coal mining	3,344,724	3,060,270	3,283,015	2,749,798	2,881,952	2,986,619	3,113,437	3,100,901	3,117,923	3,049,810	2,896,110	2,810,858
Quantity used for other mining	7,307,760	7,176,365	8,358,243	8,344,347	7,877,400	7,908,131	7,608,597	7,193,065	7,430,965	7,830,950	7,211,832	6,986,398
Quantity used for railway and other construction work	1,989,894	2,408,230	2,971,107	3,629,951	4,159,997	3,678,766	3,781,754	4,550,018	4,252,726	3,858,469	2,810,022	2,121,282
Quantity used for all other purposes	5,590,399	6,638,744	7,837,150	8,272,931	8,615,945	7,620,812	7,001,976	8,602,666	8,425,587	8,291,928	7,165,401	5,744,953
Total	18,232,777	19,283,609	22,449,515	22,997,027	23,535,294	22,194,328	21,505,764	23,446,650	23,227,201	23,031,157	20,083,365	17,663,491
Permissible explosives:												
Quantity used for coal mining	5,079,639	4,973,462	4,620,756	3,591,712	3,693,281	3,468,131	3,677,626	4,005,855	4,558,465	5,026,574	4,604,855	4,741,845
Quantity used for other mining	27,550	83,050	31,100	58,870	35,900	31,900	31,300	18,900	62,800	40,600	18,500	74,400
Quantity used for railway and other construction work	26,100	15,262	6,150	23,395	26,625	32,000	20,475	12,330	19,350	32,238	26,585	24,410
Quantity used for all other purposes	337,431	155,331	188,085	203,730	97,670	182,233	81,730	183,725	297,515	220,500	100,145	159,065
Total	5,470,720	5,227,105	4,846,091	3,877,707	3,853,476	3,714,264	3,811,131	4,220,810	4,938,130	5,319,912	4,750,085	4,999,720
Grand total:												
Quantity used for coal mining	24,070,313	22,006,632	18,617,321	13,930,160	14,563,433	15,203,375	15,921,188	17,801,706	20,665,763	22,121,509	19,810,965	20,651,703
Quantity used for other mining	7,618,810	7,515,440	8,722,143	8,768,542	8,209,475	8,182,531	8,009,922	7,444,990	7,796,915	8,113,425	7,548,832	7,238,698
Quantity used for railway and other construction work	2,552,344	3,013,442	3,451,607	4,251,546	5,100,947	4,726,691	4,546,604	5,221,048	5,124,551	5,020,507	2,930,832	2,904,467
Quantity used for all other purposes	7,114,630	7,893,800	9,167,385	9,908,886	9,327,215	8,948,920	8,367,681	10,133,891	10,349,727	9,437,978	9,082,396	6,717,143
Total	41,356,097	40,429,314	39,958,456	36,859,134	37,201,070	37,061,517	36,845,395	40,601,635	43,936,956	44,693,419	39,373,025	37,512,011

[1] The monthly sales of explosives in 1924 add to less than the total sales shown for the year because several manufacturers did not report their sales on a monthly basis.

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TABLE 16.—*Monthly fluctuations in sales of explosives and in production of coal, 1920–1923*

[Average monthly quantities equal 100 per cent]

Month	Sales of explosives			Production of coal		
	Black blasting powder	"High" explosives	Permissible explosives	Bituminous	Anthracite	Total
1924						
January	126.8	80.1	119.1	130.3	105.7	126.4
February	114.3	84.7	113.8	117.4	101.0	114.9
March	91.0	98.6	105.5	102.4	108.2	103.3
April	71.7	101.0	84.4	75.5	90.8	77.9
May	70.5	103.3	88.9	80.1	103.3	83.7
June	80.1	97.4	80.8	78.1	102.7	81.9
July	82.8	94.4	83.0	82.7	103.8	86.0
August	92.9	102.9	91.9	89.1	94.5	90.0
September	113.3	102.0	107.5	105.1	101.4	104.5
October	117.4	101.1	115.8	120.1	102.3	117.3
November	104.4	88.2	103.4	104.5	90.4	102.2
December	106.7	77.6	108.8	114.8	95.5	111.8
1923						
January	121.3	67.8	106.0	110.4	109.5	110.3
February	87.4	70.4	87.0	92.8	97.7	93.5
March	90.1	79.5	88.4	103.0	118.0	105.2
April	88.9	99.2	106.6	93.7	101.4	94.8
May	74.7	91.8	96.2	101.4	107.8	102.3
June	78.7	81.7	88.3	100.1	108.9	101.4
July	76.8	75.2	83.0	99.3	104.6	100.1
August	85.7	89.0	88.7	107.5	111.5	108.1
September	86.9	77.2	80.9	101.7	36.7	92.0
October	92.8	81.4	89.9	108.2	109.7	108.4
November	84.6	74.5	81.6	94.4	97.4	94.9
December	74.7	65.1	73.4	87.6	96.8	89.0
1922						
January	100.1	73.9	86.8	110.6	143.1	114.3
February	105.8	76.5	103.3	120.6	154.6	124.4
March	84.7	88.6	106.3	147.6	200.2	153.6
April	36.5	93.2	51.5	46.4	.6	41.2
May	54.0	100.1	44.8	59.7	.8	53.0
June	58.2	94.3	74.2	65.6	1.9	58.4
July	62.3	99.5	64.6	50.0	2.7	44.6
August	118.9	119.7	101.7	80.5	3.7	71.7
September	160.4	117.1	151.9	116.2	111.9	115.7
October	156.1	119.8	145.5	132.8	196.1	140.0
November	140.8	116.1	143.1	133.3	191.7	139.9
December	122.4	101.1	126.3	136.7	192.7	143.0
1921						
January	109.3	93.0	128.8	118.7	100.6	115.4
February	87.5	92.3	83.8	90.9	104.5	93.3
March	80.2	105.0	83.0	89.5	100.5	91.5
April	80.4	108.4	78.8	81.2	104.5	85.3
May	88.2	105.6	99.3	98.2	104.1	99.3
June	103.7	97.0	105.0	99.9	112.0	102.0
July	91.5	89.1	93.5	89.5	95.7	90.6
August	109.4	106.1	100.8	101.8	103.9	102.2
September	113.4	110.4	98.6	103.5	96.7	102.3
October	132.2	114.0	126.7	128.9	102.9	124.2
November	118.6	93.0	106.1	106.1	93.1	103.8
December	85.1	85.6	95.3	91.3	81.2	89.5
1920						
January	109.1	87.9	99.9	105.0	102.2	104.6
February	99.4	103.1	87.1	86.5	87.9	86.7
March	107.6	126.7	98.4	100.9	105.8	101.6
April	74.6	107.0	82.3	81.8	83.8	82.1
May	95.2	108.8	94.7	86.7	107.2	88.7
June	114.7	107.5	98.8	94.4	110.0	96.5
July	109.2	93.7	103.5	98.2	111.3	100.0
August	108.8	120.6	113.3	104.3	108.1	104.6
September	92.6	105.1	116.6	106.1	[1] 62.6	100.1
October	108.4	94.5	115.1	113.8	108.7	112.8
November	91.3	74.4	94.3	110.0	100.4	108.7
December	89.1	70.7	96.2	113.7	112.1	113.5

[1] A strike in the anthracite field restricted output.

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TABLE 17.—*Monthly fluctuations in sales of explosives in 1923 and 1924 by uses*

[Average monthly quantities equal 100 per cent]

Month	1923				1924			
	Coal mining	Other mining	Railway and other construction work	All other purposes	Coal mining	Other mining	Railway and other construction work	All other purposes
BLACK BLASTING POWDER								
January	149.09	51.73	87.72	88.60	137.12	99.45	76.92	98.67
February	104.03	66.23	86.82	79.80	122.46	89.81	84.60	91.43
March	107.53	61.59	76.95	90.70	93.89	116.74	68.03	94.96
April	101.79	117.03	87.42	116.83	66.51	128.15	85.79	119.07
May	82.32	90.15	125.84	101.41	70.01	103.89	131.12	51.01
June	86.91	157.93	120.02	92.46	76.67	85.07	145.69	95.27
July	87.26	10.74	96.60	90.19	80.01	129.80	106.75	106.75
August	93.73	121.60	109.44	147.07	93.73	81.74	94.46	112.03
September	98.08	142.30	114.76	99.05	113.84	106.34	122.25	135.23
October	104.98	141.12	103.19	121.52	123.09	84.85	162.02	76.95
November	96.39	113.85	110.28	95.20	107.88	111.72	13.51	151.05
December	87.81	55.79	80.91	77.10	114.80	62.40	108.82	67.60
HIGH EXPLOSIVES								
January	111.88	97.61	67.11	66.18	110.28	96.12	59.38	74.70
February	104.07	97.86	75.82	76.11	100.90	94.39	71.87	88.71
March	105.31	98.98	105.55	97.11	108.24	109.94	88.66	104.72
April	126.08	122.12	109.10	132.49	90.66	109.75	108.32	110.54
May	102.60	107.35	112.70	131.10	95.02	103.61	124.14	115.12
June	97.44	99.96	113.15	105.35	98.47	104.02	109.78	101.83
July	98.38	89.89	104.23	95.09	102.65	100.08	112.85	93.56
August	101.19	98.30	143.32	121.56	102.24	94.61	135.78	114.95
September	65.15	101.60	102.28	105.66	102.80	97.74	126.91	112.58
October	105.81	97.75	102.92	105.99	100.50	103.00	115.14	110.79
November	91.05	98.75	95.83	89.22	95.49	94.86	83.86	95.74
December	90.98	89.76	67.94	74.06	92.68	91.89	63.30	76.76
PERMISSIBLES								
January	118.59	160.05	246.53	91.88	117.13	64.21	118.22	183.46
February	99.42	58.35	72.71	68.72	114.68	193.56	69.13	84.45
March	98.83	72.37	34.17	125.29	106.55	72.48	27.86	102.26
April	118.39	112.52	99.86	152.78	82.82	137.21	105.97	110.76
May	105.82	98.05	37.02	172.53	85.16	83.67	120.60	53.10
June	96.78	130.92	125.59	139.61	79.97	74.35	144.95	99.08
July	95.32	58.35	42.62	58.02	84.80	72.95	92.74	44.44
August	98.89	116.44	110.30	107.32	92.37	44.05	55.85	99.89
September	92.48	110.89	48.79	47.22	105.11	146.37	87.65	161.75
October	101.00	61.18	69.96	112.88	115.90	94.63	146.03	119.88
November	90.75	190.73	143.82	70.26	106.18	43.12	120.42	54.45
December	83.66	30.08	168.59	53.44	109.34	173.40	110.57	86.48

CAPACITY OF MILLS

Reports from manufacturers whose sales of black powder in 1924 represented about 75 per cent of the total sales by all companies showed that their plants ran at 41 per cent of capacity during the year as compared with 51 per cent in 1923. Similar information from manufacturers of permissibles and other high explosives, whose sales represented 82 per cent of this branch of the explosives industry, showed that the quantity of explosives manufactured during 1924 was 62 per cent of the capacity of the mills reporting, as compared with 63 per cent in 1923. The sales of black powder in 1924 represented 41 per cent of the manufacturing capacity of the mills, and

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the sales of permissibles and other high explosives represented 59 per cent of the manufacturing capacity of the mills. Judged on the basis of these returns the plants operating in 1924 could have produced, if the demand had warranted, about 16,300,000 kegs of black powder instead of 6,683,000 pounds sold and 557,000,000 pounds of permissibles and other high explosives instead of the 328,000,000 pounds sold. Table 18 shows the monthly fluctuations in the quantities of explosives manufactured, sales, shipments, and stocks.

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TABLE 18.—*Relation between mill capacity and quantity of explosives manufactured and sold in 1924* [1]

BLACK BLASTING POWDER

[Quantities in kegs]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Capacity	1,050,333	1,015,333	1,029,833	1,029,833	1,029,833	1,029,833	1,029,833	1,029,833	1,029,833	1,029,833	1,029,833	1,029,833	12,363,996
Manufactured	465,751	519,690	462,629	352,945	264,597	318,082	359,238	402,897	478,428	537,412	481,137	414,777	5,057,583
Percentage of capacity	44.33	51.18	44.92	34.27	25.69	30.89	34.88	39.12	46.46	52.18	46.72	40.28	40.91
Shipments	547,792	508,482	407,660	331,820	314,045	356,702	360,549	402,732	480,335	514,288	448,223	439,891	5,112,519
Percentage of capacity	52.15	50.08	39.58	32.22	30.49	34.64	35.01	39.11	46.64	49.94	43.52	42.71	41.35
Sales	556,213	495,452	405,653	317,486	310,317	358,087	354,977	393,865	473,064	489,712	427,607	439,333	5,021,766
Percentage of capacity	52.95	48.80	39.39	30.83	30.13	34.77	34.47	38.25	45.94	47.55	41.52	42.66	40.62
Stocks, end of month	422,600	430,604	487,080	501,907	457,264	419,969	419,013	422,508	424,048	451,796	486,531	464,027	464,027
Percentage of capacity	40.23	42.41	47.30	48.74	44.40	40.78	40.69	41.03	41.18	43.87	47.24	45.06	3.75

PERMISSIBLES AND OTHER HIGH EXPLOSIVES

[Quantities in pounds]

Capacity	38,084,332	38,084,332	38,084,332	38,084,332	38,084,332	38,084,332	38,084,332	38,084,332	37,834,332	37,834,332	38,084,332	38,084,332	456,511,984
Manufactured	21,721,786	23,165,180	24,871,768	25,313,763	23,563,519	22,864,516	22,865,959	23,817,998	25,196,522	27,594,562	21,945,512	20,838,709	283,759,794
Percentage of capacity	57.04	60.82	65.31	66.47	61.87	60.04	60.04	62.54	66.60	72.94	57.62	54.72	62.16
Shipments	21,475,602	23,683,854	25,003,524	25,706,732	23,191,799	23,923,640	22,184,933	24,166,990	25,053,738	26,379,360	22,384,904	20,413,795	283,568,871
Percentage of capacity	56.39	62.19	65.65	67.50	60.90	62.82	58.25	63.46	66.22	69.72	58.78	53.60	62.12
Sales	20,687,880	21,156,951	23,360,331	23,461,043	23,802,893	22,633,610	21,891,379	23,761,651	23,950,072	24,310,966	21,822,641	19,586,238	270,425,655
Percentage of capacity	54.32	55.55	61.34	61.60	62.50	59.43	57.48	62.39	63.30	64.26	57.30	51.43	59.24
Stocks, end of month	6,884,499	6,279,475	6,173,422	5,980,690	6,311,527	5,230,863	5,923,639	5,537,772	5,712,531	6,893,733	6,191,516	6,579,931	6,579,931
Percentage of capacity	18.08	16.49	16.21	15.70	16.57	13.73	15.55	14.54	15.10	18.23	16.26	17.28	1.44

[1] Covers only mills from which monthly reports are received.

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MINE FATALITIES DUE TO EXPLOSIVES

During the past 13 years mining accidents due to the use of explosives have caused 2.6 to 5.8 per cent of all fatalities at bituminous coal mines, 4.1 to 9.6 per cent at anthracite mines, 8.7 to 14.2 per cent at metal mines, and 13.6 to 27.3 per cent at quarries. No data are available on nonfatal accidents at coal mines, but the record shows that only 1.1 to 2 per cent of all injuries at metal mines and from 1.7 to 6.3 per cent of those at quarries have been due to the use of explosives. For every fatality due to explosives since 1911 there have have been 7.6 nonfatal injuries at metal mines and 8.1 nonfatal injuries at quarries. Fatalities to underground employees at coal mines since 1911 are presented in Table 20; the figures (omitting 1919) show that 37 to 61 per cent of the fatalities occurred at the anthracite mines in Pennsylvania which have produced from 11 to 18 per cent of the coal tonnage of the United States. The anthracite mines normally consume from 52 to 68 per cent of all dynamite and other high explosives used at the coal mines in this country, 18 to 31 per cent of all permissible explosives, and 8 to 17 per cent of all black blasting powder. In 1919 the number of fatalities at anthracite mines was abnormally high (149, or 72 per cent), because of a powder explosion in Baltimore Tunnel No. 2 at Wilkes-Barre on June 5, which caused the death of 92 men.

Table 21 shows the causes of fatalities and injuries due to explosives in the mining industry in 1923.

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TABLE 19.—*Fatalities and injuries due to explosives at mines and quarries, and rates per 1,000 men employed (300-day workers)*

	Bituminous coal mines			Anthracite and bituminous coal mines			Metal mines						Quarries					
	Killed	Per cent	Rate	Killed	Per cent	Rate	Killed	Per cent	Rate	Injured	Per cent	Rate	Killed	Per cent	Rate	Injured	Per cent	Rate
1901																		
1902																		
1903	138	9.80																
1904	121	8.64																
1905	119	7.49																
1906	115	7.27																
1907	134	5.29																
1908	109	6.17																
1909	122	5.88																
1910	113	5.09																
1911	72	3.68	0.184	160	6.02	0.299	78	11.22	0.500	531	2.00	3.40	50	26.60	0.592	341	6.33	4.04
1912	70	3.85	.171	147	6.08	.271	94	14.22	.581	573	1.86	3.54	47	22.06	.501	260	3.97	2.77
1913	63	2.91	.142	138	4.96	.232	89	13.03	.485	579	1.76	3.15	44	24.04	.505	332	4.29	3.81
1914	56	3.01	.147	146	5.95	.277	60	10.73	.421	464	1.54	3.25	35	19.44	.513	265	3.38	3.89
1915	76	4.52	.202	155	6.83	.303	78	14.10	.549	388	1.10	2.73	28	18.92	.339	227	2.35	2.75
1916	60	3.59	.139	146	6.56	.258	89	12.77	.462	870	1.80	4.52	28	16.18	.366	338	2.52	4.42
1917	55	2.60	.112	110	4.08	.173	79	9.27	.411	617	1.33	3.21	21	16.03	.294	271	2.05	3.79
1918	85	4.19	.166	135	5.23	.206	89	13.78	.492	657	1.53	3.63	17	13.60	.286	151	1.73	2.55
1919	57	3.39	.141	206	8.89	.380	48	10.26	.352	412	1.31	3.05	24	19.51	.376	167	1.81	2.62
1920	79	4.44	.168	128	5.64	.213	57	13.41	.424	496	1.52	3.69	36	20.23	.467	214	1.91	2.78
1921	84	5.83	.254	152	7.65	.320	23	10.00	.309	258	1.39	3.46	17	14.17	.283	198	1.89	3.80
1922	54	3.22	.166	92	4.65	.227	30	8.72	.309	370	1.42	3.81	36	27.27	.523	288	2.43	4.18
1923	65	3.34	.116	114	4.64	.204	42	11.45	.334	459	1.37	3.77	12	8.39	.141	314	2.09	3.68
1924	47	2.49	(1)	100	4.20	(1)												

[1] Not available.

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TABLE 20.—*Coal-mine fatalities underground due to explosives, 1911 to 1924*

States	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
Pennsylvania (anthracite)	88	77	75	90	79	86	55	50	[1]149	49	68	38	49	33
Pennsylvania (bituminous)	6	8	4	7	9	10	6	6	17	22	15	10	13	1
West Virginia	3	8	8	5	6	3	6	14	6	12	14	17	14	1
Illinois	15	11	11	9	11	6	9	12	2	9	11	3	9	4
Ohio	3	5	6	2	3	5	4	8	10	10	3	5	3	4
Indiana, Michigan, and Kentucky	15	3	5	12	12	10	14	20	11	9	26	9	13	6
Alabama, Tennessee, Georgia, and North Carolina	6	6	2	2	10	3	3	5	3	6	9	1	3	1
Iowa, Kansas, and Missouri	4	14	6	4	13	9	2	7	2	3	1	----	2	----
Colorado, New Mexico, and Utah	3	1	7	4	----	4	3	3	1	4	----	2	5	3
Maryland and Virginia	----	10	2	----	4	3	2	5	2	----	----	1	1	1
Montana, North Dakota, and Wyoming	4	2	4	4	3	2	2	1	2	1	----	2	2	----
Arkansas, Oklahoma, and Texas	11	1	5	4	5	1	4	4	----	3	3	3	----	----
Alaska, California, Idaho, Nevada, Oregon, and Washington	2	1	3	3	----	4	----	----	1	----	2	1	----	----
Total	160	147	138	148	155	146	110	135	206	128	152	93	114	100

[1] Of this number, 92 men were killed in the powder explosion in Baltimore Tunnel No. 2, Wilkes-Barre, Pa., on June 5, 1919.

TABLE 21.—*Fatalities and injuries due to explosives in the mineral industry, 1923*

KILLED

Branch of mineral industry	Transportation	Charging	Suffocation	Drilling into old holes	Striking into loose rock or ore	Thawing	Caps, detonators, etc.	Unguarded shots	Returned too soon	Premature shots	Sparks from match, lamp, or candle	Delayed blast	Shot breaking through rib or pillar	Miscellaneous	Total
Quarries	1	2	----	1	----	----	----	----	2	5	----	1	----	----	12
Coal mines (underground)	5	5	9	6	1	----	3	8	15	35	4	6	4	13	114
Metal mines (underground) [1]	----	----	----	3	2	----	----	----	2	3	----	----	----	6	16
Metal mines (open pit) [1]	----	----	----	----	----	----	----	----	----	1	----	----	----	----	1
Total	6	7	9	10	3	----	3	8	19	44	4	7	4	19	143

INJURED

Quarries	13	12	----	25	26	----	6	10	13	44	----	11	----	154	324
Coal mines (underground) [2]	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Metal mines (underground) [1]	8	3	16	11	6	----	14	34	7	20	----	----	----	54	173
Metal mines (open pit) [1]	6	2	----	1	----	----	2	3	1	----	----	----	----	4	19
Total (excluding coal mines)	27	17	16	37	32	----	22	47	21	64	----	11	----	212	508

[1] From selected returns only. Details as to subdivisions not available for all metal mines.
[2] Not available.

SODATOL AND PYROTOL

In the calendar year 1924 the United States Department of Agriculture, through the Bureau of Public Roads, distributed 18,289,688 pounds of sodatol and 4,874,450 pounds of pyrotol to agencies in various States. Sodatol was distributed to 42 States and pyrotol was shipped to 36 States. Most of these explosives were intended for clearing land and for building roads. Table 22 shows the amounts shipped to the various States. In 1923 shipments amounted to

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6,737,000 pounds of sodatol and 3,587,250 pounds of picric acid; no shipments of pyrotol were reported.

TABLE 22.—*Number of pounds of* ***sodatol*** *and* ***pyrotol*** *distributed by Bureau of Public Roads, U. S. Department of Agriculture, during the calendar year 1924*

State	Sodatol					Pyrotol				
	State highway department's roads	Farmers, land clearing	Bureau of Public Roads	Other Government agencies	Total	State highway department's roads	Farmers, land clearing	Bureau of Public Roads	Other Government agencies	Total
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Alabama	29,700	76,000		2,000	107,700	5,500	72,500			78,000
Alaska			100,000	40,000	140,000					
Arizona	77,000			9,000	86,000			30,000	36,000	66,000
Arkansas	61,488	1,000		30,000	92,488	150,000	1,000			151,000
California	881,450	50,000	30,500	173,000	1,134,950	344,000	36,000	81,000	8,000	469,000
Colorado	271,700		25,000	36,450	333,150			52,400	18,000	70,400
Connecticut		38,900			38,900					
Florida		21,000			21,000					
Georgia	22,000	36,000			58,000	20,000	1,200			21,200
Idaho	70,000	531,200	7,950	30,000	639,150		36,800	19,200	11,000	67,000
Illinois	500				500		28,300			28,300
Indiana							23,500			23,500
Iowa	100,000	225,250			325,250	40,000	116,500			156,500
Kansas	44,800	1,700			46,500					
Kentucky		38,150			38,150					
Louisiana		32,600			32,600		31,500			31,500
Maine				200	200					
Maryland	2,900	1,000			3,900		1,000			1,000
Michigan	20,000	1,513,000			1,533,000		261,900			261,900
Minnesota	315,200	1,773,500		2,000	2,090,700	94,000	646,600			740,600
Mississippi	136,000	70,600			206,600	60,000				60,000
Missouri	40,700	121,000			161,700		16,900			16,900
Montana	20,600	135,200	29,000	42,000	226,200	24,000	88,650			112,650
Nebraska	5,500	47,900			53,400		18,500			18,500
Nevada			20,000		20,000					
New Hampshire	4,000				4,000	10,000				10,000
New Jersey		600			600		2,000			2,000
New Mexico		500		17,000	17,500	3,000			36,000	39,000
New York	29,000	26,000			55,000		50			50
North Carolina	125,000	657,650			782,650	70,000	339,300			409,300
Ohio	32,250	17,000			49,250					
Oklahoma						20,000				20,000
Oregon		958,800	205,000	160,100	1,323,900	14,000	452,500	54,350		520,850
Pennsylvania		42,600			42,600		1,000			1,000
South Carolina		180,700			180,700		83,000			83,000
South Dakota	136,000	73,000	32,000	12,000	253,000		25,000			25,000
Tennessee		72,800			72,800		200			200
Texas	84,000	40,050			124,050		60,000			60,000
Utah	11,900		37,000	40,000	88,900				2,500	2,500
Vermont	25,000				25,000					
Virginia	105,000			26,200	131,200	80,000				80,000
Washington	138,000	2,290,250		245,650	2,673,900	2,000	464,550	18,000	40,000	524,550
West Virginia							250			250
Wisconsin		5,044,200			5,044,200	20,000	687,100			707,100
Wyoming				30,400	30,400				15,700	15,700
Total	2,789,088	14,118,150	486,450	896,000	18,289,688	956,500	3,495,800	254,950	167,200	4,874,450

EXPLOSIVES USED IN FOREIGN COUNTRIES

Tables 23, 24, and 25 show the amount of explosives used in mining operations in Great Britain, British Columbia, and Alberta for 1911 and later years. In Great Britain, where coal mines generally use the longwall system, explosives are not required in such large quantities as in the United States. During the five years ended 1915 the consumption of explosives in Great Britain at mines

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under the coal mines act was 79 pounds per thousand net tons of coal; in the five years ended 1920 the consumption had increased to 95 pounds per thousand tons; during the next three years it was 101 pounds. The figures for British Columbia do not cover years prior to 1915, but in that year an average of 149 pounds of explosives was used per thousand net tons of coal mined in the Province; in 1923 the average was 192 pounds. During the last three years covered by the table all shot firing at coal mines in British Columbia has been by electricity. In the Province of Alberta, the consumption of explosives in 1917, the first year covered by the table, was 185 pounds per thousand tons of coal produced; by 1923, larger quantities of coal were being obtained in proportion to amount of explosives used, and the average consumption of explosives had declined to 148 pounds per thousand tons of coal.

TABLE 23.—*Explosives used at mines and quarries in Great Britain*

Year	Production [1]	Explosives used at—				Total quantity used at mines, quarries, and open workings
		Mines under the coal mines act		Mines under the metalliferous mines regulation act	Quarries under the quarries act and at other mineral workings	
		Permitted	Other			
	Net tons	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
1911	320,255,300	8,996,222	15,344,784	1,851,444	5,105,438	31,297,888
1912	305,975,041	9,011,704	14,411,434	1,885,158	4,825,961	30,134,257
1913	337,804,715	10,624,893	15,710,302	1,932,443	5,394,302	33,661,940
1914	312,575,730	8,715,211	16,805,887	1,773,800	5,098,286	32,393,184
1915	286,236,935	9,836,364	14,451,269	1,491,423	4,436,099	30,213,155
1916	299,110,504	11,010,936	14,348,740	1,606,555	3,834,996	30,801,227
1917	291,334,466	11,557,284	14,824,968	1,557,331	3,798,068	31,737,651
1918	267,587,603	11,360,191	13,235,599	1,633,052	3,640,835	29,869,677
1919	268,353,052	12,454,986	14,684,405	1,491,860	3,664,495	32,295,746
1920	268,393,080	13,562,018	15,596,562	1,584,526	4,403,032	35,146,968
1921	188,207,655	9,816,607	9,851,604	719,285	3,201,878	23,589,374
1922	286,688,300	14,254,664	13,801,281	1,039,602	4,030,780	33,216,327
1923	318,033,237	16,581,030	15,317,854	1,457,169	5,040,735	38,414,990

[1] Includes all minerals under the coal mines act.

TABLE 24.—*Explosives used in coal mines in British Columbia*

Year	Production of coal		Explosives				
	Long tons	Short tons	Pounds	Number of shots fired, total	Shots fired by electricity	Shots fired by fuse	Pounds of explosives per shot
1915	1,972,577	2,209,286	330,193	489,437	342,046	147,391	0.67
1916	2,487,820	2,786,358	503,009	667,837	550,333	117,504	.75
1917	2,398,715	2,686,561	552,157	826,107	649,128	176,979	.66
1918	2,578,725	2,888,172	536,196	645,404	638,866	6,538	.83
1919	2,408,948	2,698,022	533,707	656,585	654,463	470	.81
1920	2,696,774	3,020,387	583,994	753,496	752,405	1,091	.77
1921	2,754,526	3,085,069	582,904	775,773	775,773	----------	.75
1922	2,580,915	2,890,625	646,543	852,398	852,398	----------	.76
1923	2,542,987	2,848,145	545,952	699,000	699,000	----------	.80

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TABLE 25.—*Production of coal in the Province of Alberta, Canada, and quantities of explosives used in the mines, 1917–1923*

Year	Production of coal		Tons of coal mined per pound of explosives	Explosives					
	Long tons	Short tons		Number of pounds of explosives used	Total number of shots fired	Number of shots fired with—			
						Electric detonator	Electric squib	Fuse	Squib
1917	4,863,414	5,447,023	4.8	1,008,747	1,047,731	460,351	30,168	405,892	151,320
1918	6,148,620	6,886,454	5.6	1,089,636	967,513	584,989	34,000	200,420	148,104
1919	5,022,412	5,625,101	5.7	881,558	882,135	449,937	26,000	309,252	96,946
1920	6,908,923	7,737,994	5.8	1,185,513	1,164,858	614,030	37,060	382,558	131,210
1921	5,937,195	6,649,658	5.4	1,102,039	1,050,390	534,981	46,000	372,743	96,666
1922	5,976,432	6,693,604	4.9	1,212,182	1,118,781	370,940	71,242	561,435	115,164
1923	6,866,816	7,690,834	6.0	1,141,556	1,222,852	565,234	50,309	493,907	113,402

MANUFACTURERS OF EXPLOSIVES

Below are listed the companies that manufactured explosives in the United States during the calendar year 1924.

Companies manufacturing explosives in 1924

(B, Black powder; H, high explosives other than permissible; P, permissibles)

B.....Anthracite Powder Co., Mahonoy City, Pa.
H., P.....Apache Powder Co., Benson, Ariz.
B., H., P.....Atlas Powder Co., Wilmington, Del.
B.....Austin Powder Co., Cleveland, Ohio.
B.....Black Diamond Powder Co., Pittston, Pa.
B., H., P.....E. I. du Pont de Nemours & Co., Wilmington, Del.
B.....Egyptian Powder Co., East Alton, Ill.
B.....Equitable Powder Manufacturing Co., East Alton, Ill.
B.....Excelsior Powder Manufacturing Co., Kansas City, Mo.
H., P.....General Explosives Co., Chicago, Ill.
H., P.....Giant Powder Co., Cons., San Francisco, Calif.
B., H., P.....Grasselli Powder Co., Cleveland, Ohio.
B., H., P.....Hercules Powder Co., Wilmington, Del.
H., P.....Illinois Powder Manufacturing Co., St. Louis, Mo.
B.....King Powder Co., Cincinnati, Ohio.
B., H., P.....Peerless Explosives Co., Wilkes-Barre, Pa.
H., P.....Puget Sound & Alaska Powder Co., Everett, Wash.
H.....Rockburst Powder Co., Cleveland, Ohio.
B.....Senior Powder Co., Cincinnati, Ohio.
H., P.....Trojan Powder Co., Allentown, Pa.
H., P.....Union Explosives Co., Clarksburg, W. Va.
B.....United States Powder Co., Terre Haute, Ind.
H.....West Coast Powder Co., Everett, Wash.
B.....Western Powder Manufacturing Co., Peoria, Ill.

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PUBLICATIONS AVAILABLE FOR FREE DISTRIBUTION

BULLETIN 17. A primer on explosives for coal miners, by C. E. Munroe and Clarence Hall. 1911. 61 pp., 10 pls., 12 figs.

BULLETIN 48. The selection of explosives used in engineering and mining operations, by Clarence Hall and S. P. Howell. 1914. 50 pp., 3 pls., 7 figs.

BULLETIN 80. A primer on explosives for metal miners and quarrymen, by C. E. Munroe and Clarence Hall. 1915. 125 pp., 51 pls. 17 figs.

BULLETIN 96. The analysis of permissible explosives, by C. G. Storm. 1916. 88 pp., 3 pls., 7 figs.

BULLETIN 137. The use of permissible explosives in the coal mines of Illinois, by J. R. Fleming and J. W. Koster. 1917. 106 pp.

TECHNICAL PAPER 7. Investigations of fuse and miners' squibs, by Clarence Hall and S. P. Howell. 1912. 19 pp.

TECHNICAL PAPER 17. The effect of stemming on the efficiency of explosives, by W. O. Snelling and Clarence Hall. 1912. 20 pp., 11 figs.

TECHNICAL PAPER 78. Specific gravity separation applied to the analysis of mining explosives, by C. G. Storm and A. L. Hyde. 1914. 14 pp.

TECHNICAL PAPER 145. Sensitiveness to detonation of trinitrotoluene and tetranitromenthylanilin, by B. G. Taylor and W. C. Cope. 1916. 11 pp.

TECHNICAL PAPER 160. The determination of nitrogen in substances used in explosives, by W. C. Cope and G. B. Taylor. 1917. 46 pp., 1 pl., 4 figs.

TECHNICAL PAPER 162. Initial priming substances for high explosives, by G. B. Taylor and W. C. Cope. 1917. 32 pp.

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